DOCUMENT RESUME

ED 022 458

JC 680 332

By- Allen, David; And Others

POLYSENSORY LEARNING THROUGH MULTI-MEDIA INSTRUCTION IN TRADE AND TECHNICAL EDUCATION.

California State Dept. of Education, Sacramento. Bureau of Industrial Education.; California Univ., Los Angeles. Div. of Vocational Education.

Pub Date 68

Note- 68p.

EDRS Price MF-$0.50 HC-$2.80

Descriptors- *AUTOINSTRUCTIONAL AIDS, INSTRUCTIONAL MEDIA, *JUNIOR COLLEGES, *TECHNICAL EDUCATION, *TRADE AND INDUSTRIAL EDUCATION

Identifiers- *California

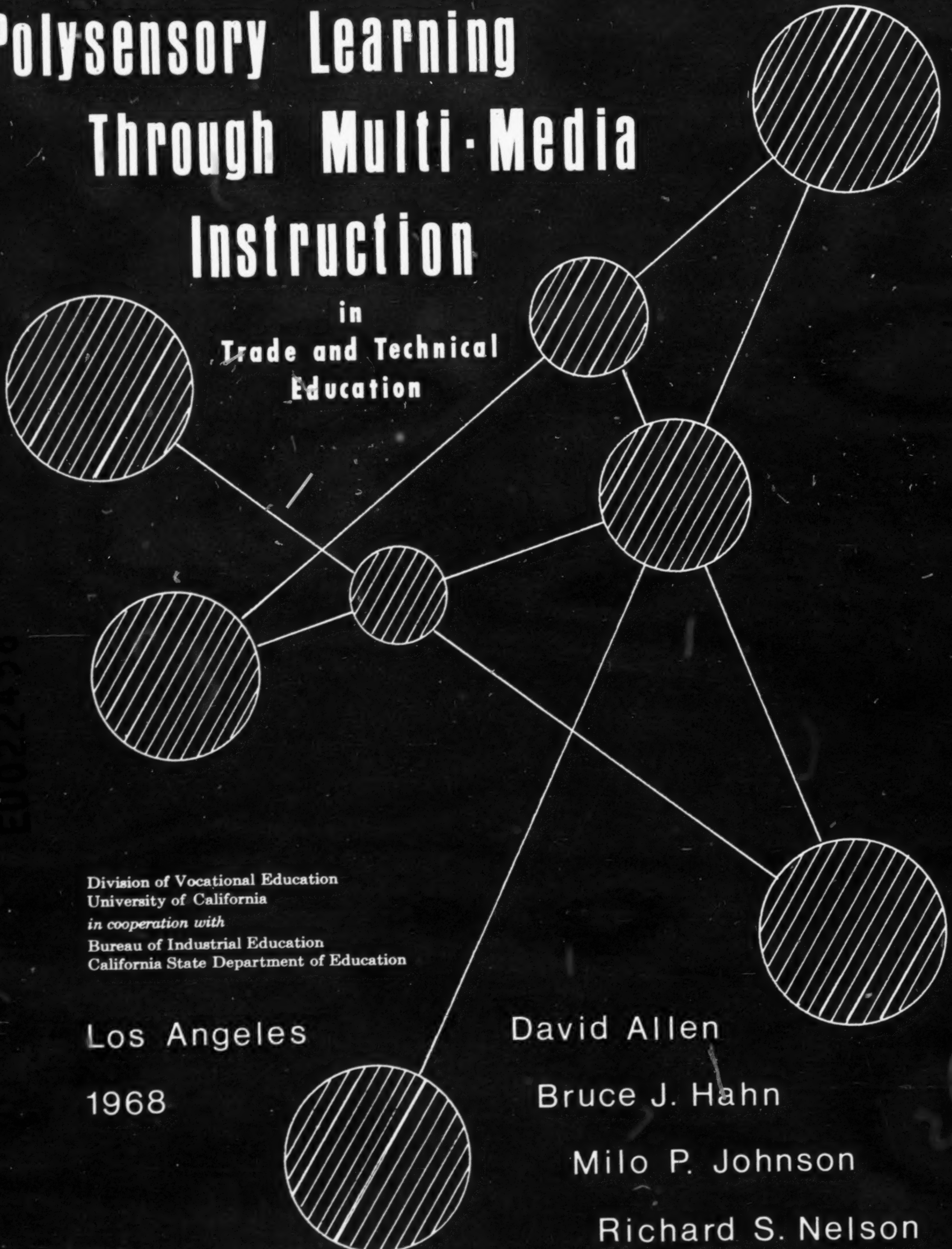
This report explains a teaching system designed to stimulate polysensory learning by use of multi-media instructional materials, which use as many of the physical senses as practical to augment traditional instruction. They include motion pictures, filmstrips, audio tapes, models, mock-ups, etc., according to school facilities and course needs. Care should be used in buying such expensive media as 8mm sound films, since technical instruction needs constant updating; tapes and filmstrips are low in cost and easy to produce. The system is planned for use by each student at a study booth providing privacy and protection from distraction. The student may use the material at his own pace, before or after a shop, laboratory, or small-group discussion. This system is expected to stimulate motor skills, cognitive learning, and the concomitant attitudes of appreciation, responsibility, etc., appropriate to the student's maturity. This individualized instruction and traditional teaching are compared in detail by objective, technique, work method, evaluation, and the role of advisory committees, supervisors, or administrators. Ideally the multi-media method is so organized and used that the program is systematically evaluated and revised to meet realistic student performance goals efficiently. Details of the system, examples of its use, methods of preparing the materials, evaluation of its results, and its future possibilities are presented. (HH)

ED022458

Polysensory Learning Through Multi-Media Instruction

in

Trade and Technical Education



Division of Vocational Education
University of California
in cooperation with
Bureau of Industrial Education
California State Department of Education

Los Angeles

1968

David Allen

Bruce J. Hahn

Milo P. Johnson

Richard S. Nelson

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

POLYSENSORY LEARNING THROUGH MULTI-MEDIA INSTRUCTION IN TRADE AND TECHNICAL EDUCATION

David Allen, Bruce J. Hahn, Milo P. Johnson, and Richard S. Nelson

JC 680 332

Division of Vocational Education, University of California

in cooperation with

Bureau of Industrial Education
California State Department of Education

Los Angeles, California, 1968

About the Authors

David Allen is Coordinator, Professional Resources Development Unit, Bureau of Industrial Education, California State Department of Education.

Bruce J. Hahn is Special Supervisor, Trade-Technical Teacher Education, Division of Vocational Education, University of California.

Milo P. Johnson is President and Superintendent, Mt. San Jacinto College.

Richard S. Nelson is Chief, Bureau of Industrial Education, California State Department of Education.

"PERMISSION TO REPRODUCE THIS
COPYRIGHTED MATERIAL HAS BEEN GRANTED
BY JOHN GOODLAD (EDUC.-UCLA) FOR
REGENTS OF UNIV. OF CALIFORNIA
TO ERIC AND ORGANIZATIONS OPERATING
UNDER AGREEMENTS WITH THE U.S. OFFICE OF
EDUCATION. FURTHER REPRODUCTION OUTSIDE
THE ERIC SYSTEM REQUIRES PERMISSION OF
THE COPYRIGHT OWNER."

Copyright © Board of Regents of the University of California, 1968. All rights reserved.

Library of Congress Catalog Card Number 68-64267.

PREFACE

This publication explains a teaching system designed to stimulate polysensory learning through a variety of devices and materials that generally are referred to as multi-media instructional materials. It describes the use of multi-media instructional materials in Trade and Technical Teacher Education, and in Auto Mechanics and Auto Body and Fender Repair classes. Examples of individualized multi-media instructional materials for all three of these programs have been included.

Trade-technical education consists of both technical instruction and the development of manipulative skills, so that a student may enter an occupation to earn a living, or advance in the occupation in which he already is employed. The relationship between the amount of technical information (the understanding of laws of science and principles of technology as applied to modern design and production, along with related industrial information) and manipulative skills required is dependent upon the specific requirements of the many vocations falling within the categorical range of trade and technical occupations. Occupations within this range may be the skilled trades, technician occupations, health occupations, personal services, public services, and others.

The instructional system and the methods for producing the media described here are a result of ongoing programs at Mt. San Jacinto College which are operating through the coordinated efforts of the trade-technical teacher education staff, Division of Vocational Education, University of California, and the California State Department of Education, Bureau of Industrial Education. Mt. San Jacinto, a small public junior college located at Gilman Hot Springs, California, has a teaching staff and a staff of technicians who have been working for two years on the development of multi-media materials. This reflects the school's continuing interest in multi-media techniques.

Information provided herein can be used by most schools. Examples of film strips, audio tapes, and worksheets that are used in the classes described are included. It is hoped that others will be encouraged to utilize individualized multi-media instruction, making their own modifications and improvements.

The Authors

CHAPTER I

INDIVIDUALIZED INSTRUCTION

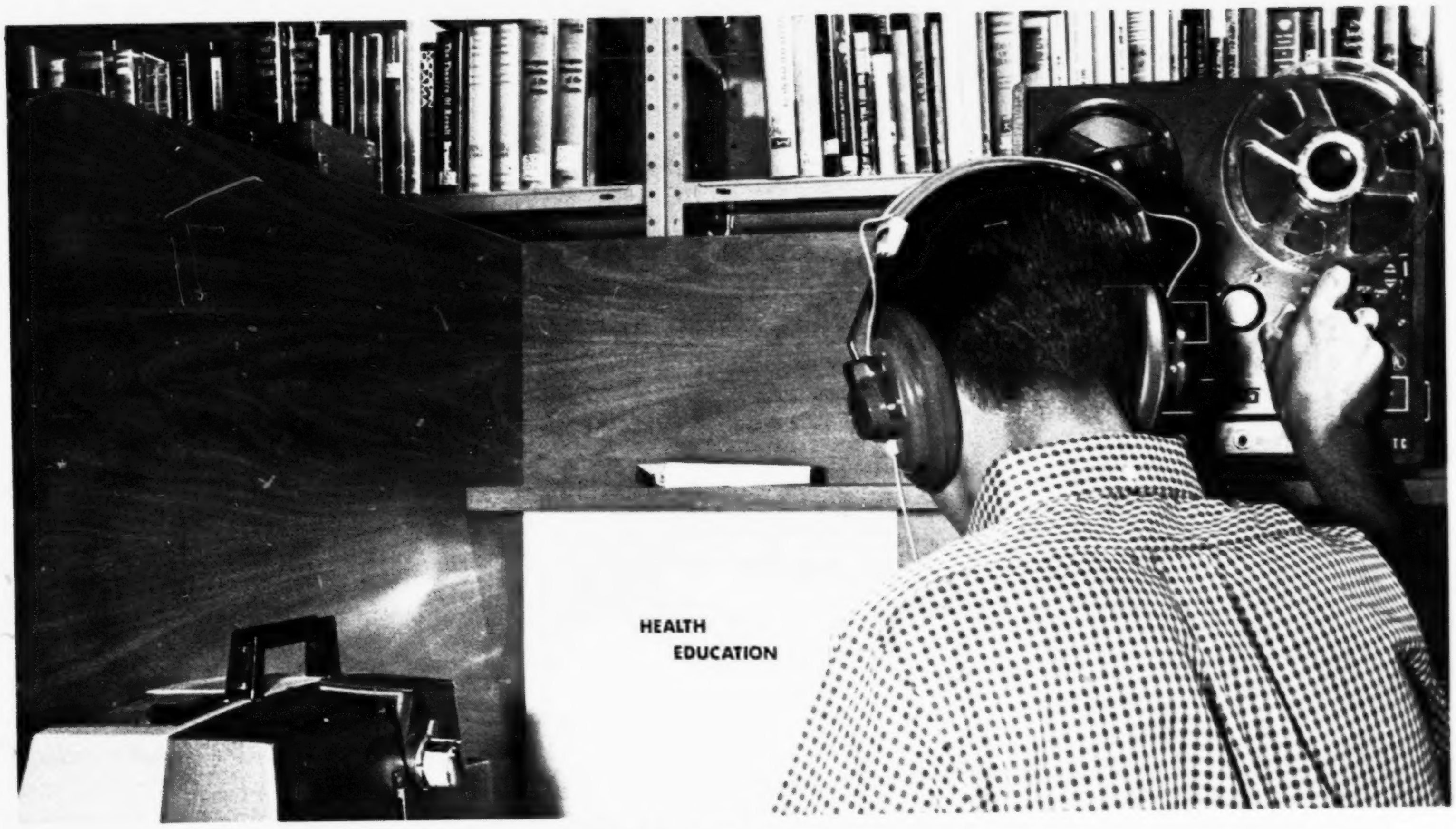
Polysensory learning through multi-media instruction utilizes as many of the physical senses as practical in augmenting the lecture-reading approach to instruction. Multi-media refers to instructional materials of several kinds, coordinated for simultaneous use in individualized self-instruction. These instructional materials may range through motion pictures, filmstrips, models, mock-ups, etc., depending on the facilities of the school and the requirements of the course content.

The Individualized Multi-Media System

It is in the presentation of technical instruction that individualized multi-media instruction effects its greatest modification in the present widely-used traditional instructional program. In the individualized multi-media system, most of the teacher-lectures and some of the classroom demonstrations are replaced by commercially prepared or teacher-designed filmstrips, audio tapes, and worksheets. The audio tapes are magnetic tape recordings used in conjunction with and related closely to visual media, so that the sound and the visual materials form an integrated presentation. The worksheets are designed for use with specific visual media (usually filmstrips) and coordinated audio tapes. These worksheets are study guides, usually produced by some standard duplicating process, which are used by the students to measure their own learning during an individualized multi-media lesson. The students answer questions or perform prescribed tasks based on immediately preceding instruction provided by the visual media and/or audio tape.

The entire individualized multi-media system is planned for use by each student at a study booth — an individual student station which provides a degree of privacy and isolation from outside visual and/or auditory distraction. Each study booth is equipped with a filmstrip projector, tape recorder, and space to write answers on the worksheets.

Whereas most filmstrips have, in the past, been prepared for all of the students to see and hear in a group, and then, at the end of the showing, to answer a quiz about the materials taught, the individualized multi-media system uses filmstrips and tapes which are designed for students to use at their own pace, at the time when the learning of technical information is most appropriate. The student may use the multi-media material at assigned periods prior to or after


HEALTH
EDUCATION

Student Study Booth

Multi-Media Storage

"whole class" or "small group" sessions, or during a shop or laboratory activity at a point in his learning when additional technical information is required.

Frequent questions are included in the audio tape or filmstrip frames, instructing the student to write answers to questions, draw a diagram, or otherwise demonstrate that he has learned what was just presented. He then is given auditory or visual information that lets him know whether his answer or action is correct. This effects feedback to the student and provides him with immediate knowledge of his learning. The student is encouraged to turn back the filmstrip and audio tape to review the points where he needs to strengthen his learning.

Although in the individualized multi-media system strong emphasis is placed on the use of filmstrip and coordinated audio tapes specially designed for use by students working alone, other media and methods also are utilized with students, either in small groups or as a "whole class." These include textbooks, motion pictures and other projected aids, demonstrations and discussion sessions, job operation or procedure sheets, and practice in the shop or laboratory.

Because of their low cost and ease of production, filmstrips and tapes have been selected as the primary means of providing the visual element of the individualized instructional system. Color slides, made up in sets and kept in closed trays, can be used in place of filmstrips if only a few duplicate sets are needed to accommodate the number of students working on the same lesson at the same time. Comparisons of slides and filmstrips appear in Chapter IV.

Other individualized media that could be selected include cartridge-type 8 MM sound motion pictures, video tapes with individual playback and viewer or with dual access to audio equipment, and computer-assisted instruction, with or without visuals. All these are feasible choices that may be practical for classroom instruction at some time in the future. All of these currently seem to be too costly for initial production and for the original investment in equipment for student stations. They also appear too costly to permit the modification of technical content which must occur at frequent intervals to validate and update the instructional material.

Small Group Instruction

With the instructor freed from the demands on his time made by routine classroom lectures and many classroom demonstrations, more of the time previously allocated to related instruction can be devoted to helping individual students who need assistance, and to working with small groups of students. Individual and small group discussion of the related information helps students to learn to make application of and to synthesize the facts and principles, by using the knowledge acquired through the use of multi-media.

A Model for Multi-Media Instruction in Trade-Technical Subjects

Three major elements make up the learning experiences for students in trade-technical education. These elements are motor skill development, cognitive learning of technical information, and concomitant outcomes (the accompanying learning concerned with attitudes, appreciations, responsibilities, etc.) that are in concinnity with the student's maturity.

All three of these elements have varying levels of achievement that a student is required to attain to become successful in an occupation. The ratios between these elements differ from the limits of either extreme for the many occupations in the spectrum of the trade and technical occupations. Just as there are differences among individuals, there are differences in the requirements for the attainment of these three elements in relation to the various occupations, as well as differences in achievement for the various learnings within a curriculum for any one occupation.

It is conceivable that some predetermined levels within a curriculum are inappropriate for some students. Thus, the model for multi-media instruction must establish a base for instructional management that permits the instructor to assist each student to progress in the direction of his fullest capabilities and that, at the same time, provides the student with immediate knowledge of his learning progress. Motor skill development can be sensed by the student and observed by the instructor. It is equally important to make both the student and the instructor aware of learning performance in the area of cognitive learning and concomitant outcomes. It is through individualized multi-media instruction that a student proceeds at his own pace, is provided with immediate knowledge of his learning progress, and acquires his learning through a system that teaches by means of coordinated polysensory instructional methods and materials.

Unlike the traditional approach to instruction, individualized multi-media instruction is based on precise student performance goals.* These goals are stated not in terms of what the instructor intends to accomplish, but rather in terms of what a student will become able to do, how he will do it, and what level of achievement he must attain. In addition, individualized multi-media instruction is logically arranged in short, easy steps that assist in successful learning. The student is required to be an active participant in the instructional process by constantly interacting with the multi-media materials, and through interaction in class activities.

Class activities may occur in one of three group sizes. The class may be a "whole class" and consist of all the students enrolled in the course, who participate in the educational process at the same time and in the same place. On the other hand, the class may be divided into small groups of six to fifteen students meeting with the instructor, who serves as discussion leader. In the small group, the method of instruction is primarily verbal interaction among students on selected lesson topics, for which they have been prepared by utilizing an assigned individualized multi-media activity. The third size of unit is the individual session held between the instructor and one student, in which the objective may be instruction or advisement.

---

*The term, student performance goals, resulted from a series of attempts, beginning in 1965, to better convey the concepts of behavioral objectives to teachers enrolled in trade-technical teacher education in California.

Comparison Between Individualized Multi-media and Traditional Instruction

Many efforts are made by trade-technical instructors to assist their students in learning technical information through the various physical senses. These teachers make use of methods and materials that appeal to the senses, such as models, pictures, illustrations, and other instructional aids, in addition to reading and note-taking. In most cases, however, the instructional methods and aids involve only two of the senses — sight and hearing. There is little evidence that the present use of instructional aids is coordinated into the learning process so that each student receives full impact of the instruction and the instructor is aware of each student's progress. Moreover, the student is unable to determine how well and how accurately he is learning at the time instruction is occurring. Through individualized multi-media instruction, a system is provided whereby each student progresses at his own learning rate, utilizing many sensory experiences, and receiving continual feedback as to how well he is progressing. The student's interaction with the instructional materials of the individualized multi-media instructional system is recorded and the instructor maintains contact with the student's success in mastering course content.

In comparing the individualized multi-media instructional system with typical traditional teaching programs currently utilized by most of the successful teachers of trade-technical subjects, the following differences are identified:

- Traditional Teaching

  Instructors prepare objectives stating what they intend to do with respect to the teaching of skills, knowledge, and attitudes (generally stated as teacher-center objectives).

- Individualized Multi-Media Instruction

  Instructors prepare student performance goals, stating what the student will do, how it will be done, and the minimum acceptable level of proficiency expected of the student. The writing of student performance goals is based on requirements of the various tasks performed in an occupation.

- Traditional Teaching

  Students receive technical instruction as a group, and listen to lectures, observe demonstrations, discuss information from their textbooks, view motion pictures or filmstrips as a class group activity and, in some cases, use individual instruction information sheets in order to gain related knowledge or to apply it to the skills to be learned at a later time.

- Individualized Multi-Media Instruction

  Students receive technical instruction through the use of the individualized multi-media instructional system. Individual student-instructor tutorial contacts and small group discussion sessions having specific learning goals complement the student's independent study with the system.

- Traditional Teaching

  Students work in the shop or laboratory where skills of the occupation are learned individually while performing simulated or real jobs through the assistance of teacher-prepared job sheets or procedure sheets, blueprints, or schematic drawings, and with the constant assistance of an instructor who demonstrates and observes students' practice. The instructor corrects student mistakes and advances the student through the course as each task is successfully completed.

- Individualized Multi-Media Instruction

  Students work in the shop or laboratory where skills and occupations are learned, as in the traditional method; however, the individualized multi-media instructional system equipment is located within the shop or lab and the student utilizes the system in learning technical information at the time it is appropriate to his manipulative learnings. The student has continuous feedback as to the progress of his learning and the instructor has continuous evidence on how well the student is progressing so that he may properly assist the student in learning.

- Traditional Teaching

  Instructors evaluate each student's learning in the classroom at convenient intervals to determine the amount of related knowledge which was successfully taught by the instructor. Student learning usually is identified through teacher-prepared examinations. Evaluation of the student's learning in the shop or laboratory is effected by means of teacher-designed performance tests to determine whether the student is ready to enter employment in the occupation for which he has received training.

- Individualized Multi-Media Instruction

  Instructors evaluate each student's learning from examinations designed to test the achievement of student performance goals. The evaluation of the student's learning is continually done by the instructor through reading completed students' worksheets and interpreting students' grasp of the subject through individual and small group discussions. The evaluations of both written and manipulative tests are carefully prepared to ascertain the extent to which students reach the predetermined student performance goals. The course then is evaluated on the basis of students' success in meeting their performance goals. Modifications are made in the goals, the media, the length of time spent on each instructional unit, or any other part of the system which is judged to be in need of improvement.

- Traditional Teaching

  Advisory committees, supervisors or administrators, along with instructors, conduct an informal subject review of the course to determine what elements of the teaching methods or content should be modified to make the instructional program more successful.

- Individualized Multi-Media Instruction

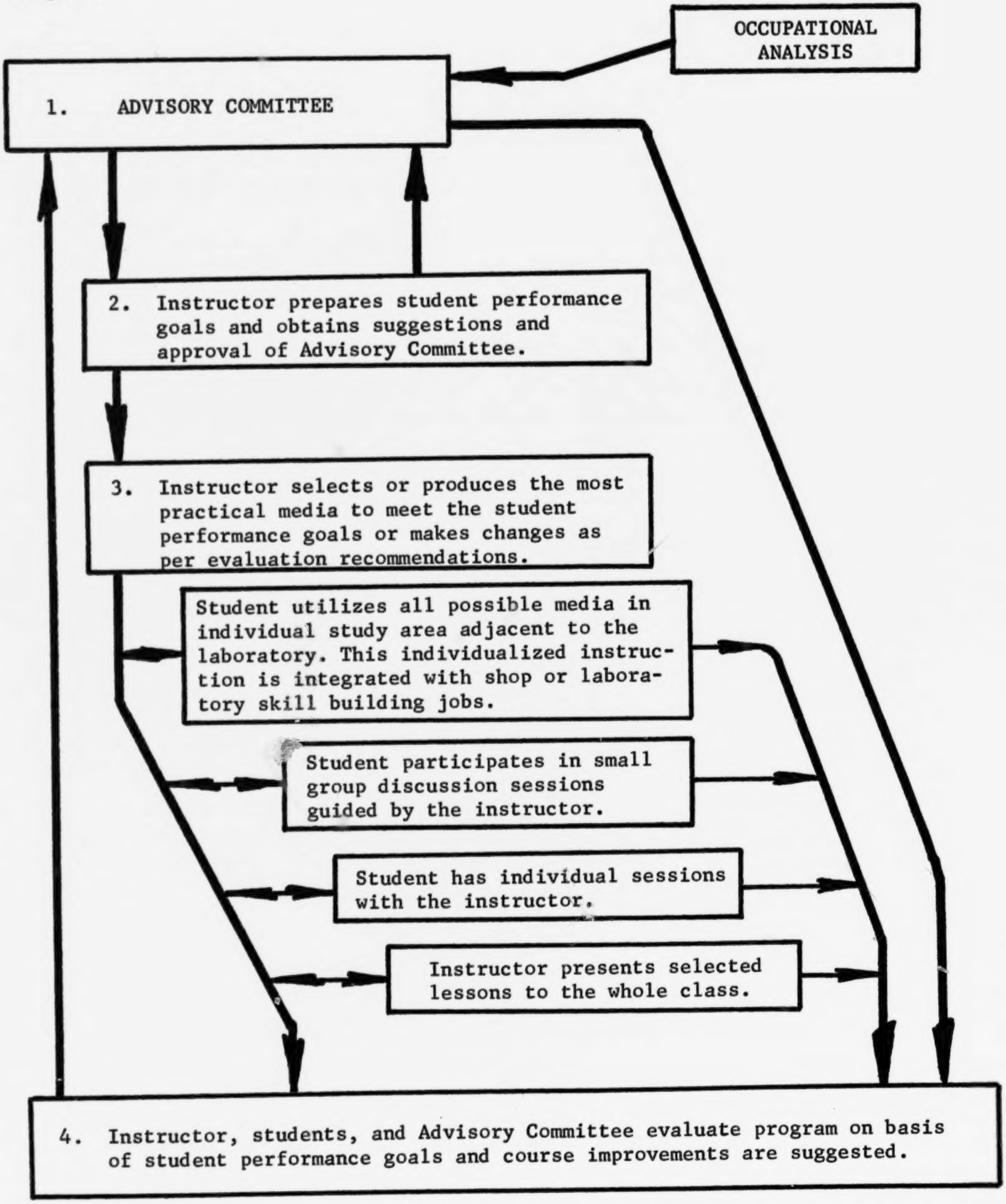
  Advisory committees, supervisors or administrators, along with instructors and students, review the students' performance goals in light of students' accomplishments so that teaching methods and course content can be modified to make the instructional program more successful.

Although the traditional instructional procedures outlined above have been used successfully by many teachers of trade-technical subjects, there are several areas in the traditional instructional program which the individualized multi-media instructional system proposes to modify and to strengthen. The inportance of having a learner's many senses involved during instruction has been recognized and accepted. It is fortunate that because of the subject matter, instruction

in trade-technical courses permits the involvement of many senses while learning is in process, particularly in learning manipulative skills. Unfortunately, much of the teaching of technical instruction in trade and technical classes is done by the lecture method, which does not exploit the inherent polysensory potentials of most trade-technical curricula.

The individualized multi-media instructional system contributes to the learning of technical information by assisting each student to learn through his many senses. The visual sense responds in viewing films and slides; the auditory sense, in listening to tape recorded descriptions and instruction; the tactile sense, in investigating weight, texture, and other physical attributes of materials and objects; the kinesthetic sense, in actually performing an operation, such as judging torque in tightening a bolt; and so on.

The individualized multi-media instructional system consists of instructional methods and materials so organized and utilized that the program is systematically validated and revised to meet realistic student performance goals with optimum effectiveness and efficiency. Thus, polysensory learning through an individualized multi-media instructional system introduces the use of the many physical senses in the learning experience in addition to those encountered in the manipulative phases of instruction, and each student has an opportunity to receive the largest share of his technical instruction with media and equipment that he can use and pace in accordance with his own learning speed. Figure 1 displays the various elements of the individualized multi-media instructional system and their interrelationships.



OCCUPATIONAL ANALYSIS

1. ADVISORY COMMITTEE

2. Instructor prepares student performance goals and obtains suggestions and approval of Advisory Committee.

3. Instructor selects or produces the most practical media to meet the student performance goals or makes changes as per evaluation recommendations.

Student utilizes all possible media in individual study area adjacent to the laboratory. This individualized instruction is integrated with shop or laboratory skill building jobs.

Student participates in small group discussion sessions guided by the instructor.

Student has individual sessions with the instructor.

Instructor presents selected lessons to the whole class.

4. Instructor, students, and Advisory Committee evaluate program on basis of student performance goals and course improvements are suggested.

Interrelationship between multi-media elements

CHAPTER II

BASIC ELEMENTS OF THE INDIVIDUALIZED MULTI-MEDIA INSTRUCTIONAL SYSTEM

In analyzing the individualized multi-media instructional system, three elements must be considered. These are the instructional media, the instructional environment, and the evaluation process that results in corrective refinements in the instructional system. Each of these three elements has its own major subdivisions. A thorough understanding of these subdivisions is required if an effective individualized multi-media instructional system is to be developed.

THE INSTRUCTIONAL MEDIA

Modified Programmed Instruction

The filmstrips, coordinated audio tapes, and student worksheets which were first developed for the trade-technical teacher training classes, and those written for the first academic course programs at Mt. San Jacinto College, resembled illustrated brief lectures with check-up quizzes prepared for use by the individual student rather than for a whole class. As these media were evaluated by the instructor, advisory committee members, students, and administrators, it became evident that material could be improved by requiring students to respond more frequently to meaningful check-up questions.

It then was decided to give students immediate confirmation of their responses by showing the correct answer in the next filmstrip frame, by telling the correct answer on the audio tape, or by providing the correct response on another page of the worksheet. Any one of these methods of immediate confirmation, or a combination, was used in individualized multi-media lessons. As revision of the material took place after it had been used and evaluated, it began to approach the format of commonly used programmed instruction; however, the instructional steps were larger than most programmed instructional segments. Although these instructional steps were larger, responses from the students still were required at relatively frequent intervals. Other modifications included the use of projected visual material in color, and providing the student with immediate confirmation of his response by one of the three methods described above.

The justification for presenting material in larger steps when using this system of instruction is that the student can learn more effectively when multi-media materials are used — in this case, filmstrips coordinated with audio tape and duplicated student worksheets. Larger instructional steps reduce the risk of the tediousness that results from breaking material into very small steps, a complaint of some who use linear programmed materials. Branching multi-media programs which permit varying rates of learning will be discussed in the last chapter — Future Improvement and Expansion.

The following is a comparison of some elements of programmed instruction with those of modified programmed instruction utilized in the individualized multi-media instructional system:

Programmed Instruction	Modified Programmed Instruction Used In The Multi-Media System
1. Establish observable student behavioral objectives for each lesson.	1. Establish student performance goals stated as observable acts that can be accepted as evidence that the student has met an established standard.
2. Present instruction in written form in very small steps, frequently just a sentence or two.	2. Present instruction visually through filmstrips with coordinated audio tape in moderate to large size steps, several sentences or sometimes two or three paragraphs in length.
3. Require student to respond to a written completion or multiple choice question, and to both check up and reinforce the material learned in each small step.	3. Require student to respond to a question presented as part of the filmstrip, or orally as part of the audio tape, or as a part of the student worksheet. The question may be answered non-verbally by drawing a diagram or solving a problem, or by applying in some other manner the information learned. He may also answer the written question by writing in his own student worksheet. The student response serves as both a check-up for the previous step of instruction and as a means of reinforcing the learning.

Programmed Instruction	Modified Programmed Instruction Used In The Multi-Media System
4. Provide student with immediate confirmation of the correctness of his response. This is usually done by uncovering the missing word in the completion-type question.	4. Provide the student with immediate confirmation of the correctness of his response. This may be done visually on the next filmstrip frame, by audio tape, or by printed words on the next page on his worksheet. Using this variety of approaches to confirmation helps to maintain interest.
5. Make it possible for students to pace themselves. The faster students can proceed through the program more rapidly if they read faster or, in the case of some programs that utilize branching, students may skip some of the steps of the program, or they can go into one branch to a greater depth.	5. Make it possible for students who operate filmstrip projectors and tape recorders at individual study booths to turn them back to repeat the material, all or any part, as frequently as necessary to meet the student performance goal. Branching features can be developed in this instructional system.
6. Provide students with continuous information about how they are progressing.	6. Provide students with continuous information about how they are progressing toward their student performance goals.

Levels of Instruction

Curriculum development in trade-technical education, as in all other instructional areas of vocational education, is based on an analysis of the skills, technical knowledge, and concomitant outcomes that are required either for an individual to enter an occupation and successfully advance in that occupation, or for him to further advance in an occupation in which he is employed. It is not the purpose of this publication to describe the methods for occupational analysis*, which in turn leads to course outlines and courses of study: rather, this publication is based on the assumption that those planning to prepare multi-media instructional materials have available a course outline based on an occupational analysis that has been refined through the assistance of an advisory committee or knowledgeable industrial consultants. It should be noted that the methods for analyzing can be learned; if the analysis is conducted with the goal of establishing curriculum, the levels of instruction will automatically be identified.

---

*Occupational analysis consists of both an inventory of tasks within an occupation by levels of required proficiency, and analysis of these tasks in relationship to curriculum development.

"Levels of instruction" refers to the depth of instruction, so that specific skills and knowledge are specified for minimal expected achievements by individual students, in order that they may meet the requirements for successful employment. Various classification names have been used by experts in the field of curriculum development. These classifications may be found in taxonomies. It has been found by trade-technical teachers that a three-level classification is adequate and appropriate to the majority of instructional activities in which their students are involved. These levels are determined by careful study of the tasks of the occupation covered by the occupational analysis, in terms of the degree of manipulative skill needed, of technical knowledge required, the frequency with which the worker performs them, the hazards inherent in the tasks, and the extent to which specialization is practiced.

In the three-level structure, the first level (recognition) is concerned with the student's ability to follow directions. The student has to remember facts. Instruction is to such a depth that a student recognizes an item after his memory is jogged. It requires sufficient knowledge of relationships and associated principles needed to make information being taught meaningful in a job-like situation. The student should know sources from which he may obtain information, and must develop the ability to follow directions. Motor skills developed at this level should provide perceptual awareness through sensory stimulation and sensory cues that identify a relationship with specific motor activities.

Level 1, as in the case of the other two levels, is achieved through purposeful instructional activities. Although individualized multi-media instruction is concerned with the learning of technical information, the motor skill levels are discussed so that the reader is aware that levels of instruction are also applicable to motor skills. As discussed in Chapter I, the levels for motor skills and technical knowledge are not the same for any one task in any one of the many occupations for which instruction is being given. Thus, Level 1 sometimes can be reached without actually applying the information through job practice.

Some examples of Level 1 instruction are information about alloy materials used to make high speed drills for drill press operators, solvent characteristics for dry cleaners, and pharmaceutical ingredients of certain medicines for licensed vocational nurses. Students must know such information in a context broad enough to make it useful when they become employed.

Level 2 (recall) provides instruction to the depth that a student successfully remembers something which has been learned previously. The student's ability is developed to the degree that he can interpret diagrams, drawings, blueprints, tables, information in manuals, etc. At this level, the student develops abilities to translate mathematical verbal material into symbolic statements, and vice versa. Motor skills that are required permit performance, usually of limited duration, having durable qualities. The motor activity is complemented by guided response. Some examples of Level 2 instruction would include the packing of automobile wheel bearings and making proper adjustments, through the use of information in a manual; the selection of wire of proper size, based on a given wire size table, so that an electrical installation meets code requirements; and the interpretation of a patient's chart entries by a nurse, so that proper bedside care is administered.

The top level in this classification system is Level 3 (reorganization.) This level denotes the process by which a student faced with a new problem or situation has the ability to recognize common factors and bring many sources and types of information to bear on a new solution. At this level, knowledge and skills are learned in sufficient breadth and depth for the student to transfer earlier learnings to a new set of circumstances. It may involve reflections on the consequences to be expected if an action is taken. Instruction should develop the student's ability to apply principles, concepts, and theories to specific situations. Some tasks that the student learns will require the ability to analyze or to synthesize, so that a problem or activity can be solved or performed. At this level, refined motor skills are developed. These skills are complex motor activities whereby performance is efficiently and smoothly executed. The mental and physical qualities of the task are retained during the aging process. Level 3 provides a base for transfer of learning, so that when the student is employed he can perform productively with a minimum of additional job training.

In summary, the three levels of instruction may be identified as follows:

Level 1. Recognition

As characterized by:

1. Remembering facts.
2. Recognizing items in response to prompts.
3. Matching items to establish relationships.
4. Classifying ideas and generalizations.
5. Following written and oral directions.
6. Demonstrating perceptual awareness in motor skill activity from cues.

Examples:

1. Identifying alloys used to make high speed drill bits.
2. Matching characteristics of dry cleaning agents with their names.
3. Classifying medicines according to pharmaceutical ingredients.
4. Selecting a complete set of tools needed to perform a given task.
5. Locating appropriate sources of information in order to perform a given task.

Level 2. Recall

As characterized by:

1. Recalling specific information.
2. Interpreting diagrams, drawings, blueprints, tables, symbols, and graphs.
3. Translating mathematical symbols and verbal statements back and forth.
4. Performing motor skills of limited duration, but having durable qualities, complemented by guided response.

Examples:

1. Repacking and adjusting automobile front wheel bearings according to an instruction manual.
2. Selecting and installing the proper wire according to a specified wire size table in accordance with building code requirements.
3. Providing proper bedside care based upon interpretation of a patient's medical record chart.
4. Restating ideas obtained from written component operational descriptions.
5. Deriving universal or conditional mathematical sentences depicting proportional relationships.

Level 3. Reorganization

As characterized by:

1. Recognizing common factors that apply to a new problem or situation.
2. Transferring earlier learnings to the solution of new situations.
3. Ability to analyze and/or synthesize in order to maintain continual operation of an intricate system and its components.
4. Weighing the consequences resulting from any action taken.
5. Planning and performing all specified task-oriented manipulations.

Examples:

1. Designing a structural complex incorporating loads, codes, and economic considerations.
2. Determining internal and external performance characteristics of a system and formulating an equivalent model.
3. Designing and manufacturing a mass-production item that has parts that move.
4. Deducing that an emergency exists from the analysis of a given patient medical record.
5. Identifying the quiescent parameters of an electronic "Black Box".

To attempt to teach all parts of a course to the highest level would be both unrealistic and too time-consuming, even if it were possible. An electronics technician must know something about the characteristics and kinds of solder (Level 1) and he must actually solder connections, using manufacturer's specifications (Level 2), but he does not need the transfer knowledge about solder that might be needed by a metallurgist or a research worker for a manufacturer of solders. On the other hand, his ability to analyze and trace circuits must be transferrable to devices which he never has seen (Level 3).

PERFORMANCE GOALS

LEVEL	GOAL	Σ	%
3	𝍸 |	6	15
2	𝍸 𝍸 𝍸 |	16	40
1	𝍸 𝍸 𝍸 |||	18	45
		40	100

Distribution of Student Performance Goals

Experience has shown that vocational teachers are able to specify expected levels of instruction in their own occupational fields with considerable agreement with each other. The mechanics of classification require simply writing 1, 2 or 3 after each statement of a goal and making a tally of each of the three numbers. For the instructor who is thoroughly oriented to the student performance goal concept (to be discussed next), one hour is enough time in which to classify and tabulate a whole set of instructional levels. The general structure of the course and the relative emphasis at each level are indicated through a simple numerical tabulation. If a course planned as related instruction for apprentices comes out 90 percent Level 2, or a skill course shows 80 percent Level 1, some re-planning undoubtedly is necessary.

Each instructional activity is classified at the highest level to which it is to be taught. All students may not achieve this level, even though it is a desirable level for successful entry to an occupation. A careful estimate can be made by the instructor of the percentage of a class that can reasonably be expected to reach the designated level. This can be written as a percentage alongside the level designation. It provides a good basis for comparing planned achievement with actual achievement, when progress records have been completed.

Student Performance Goals

The most significant major subdivision of the instructional media element is the student performance goal. Student performance goals identify what changes are expected to take place in the performance of the student as a result of the educational program. Student performance goals describe what the instructor expects as outcomes of his instruction, rather than stating purposes or his own teaching objectives.

Writers in the field of education have written a great deal of late about terminal behavioral objectives. In particular, Arthur Cohen[1] of UCLA and Robert F. Mager[2] have dealt with this subject. Because, in the minds of so many educators, "objectives" means a listing of what they as teachers expect to do in a given course, there appears to be a barrier established in communications when discussing terminal behavioral objectives. Through experimentation in trade-technical teacher education classes involving over 1200 teachers, and through a research project concerned with the training of aviation mechanics[3], it has been found that the term, "student performance goal" (another name for terminal behavioral objectives), has permitted effective and efficient communication for the behavioral objective concepts. The term, "student performance goals" has been adopted for trade-technical teacher education and trade-technical curriculum development in California.

---

[1] Arthur M. Cohen, "Defining Instructional Objectives," in B. Lamar Johnson (ed.), Systems Approaches to Curriculum and Instruction in the Open Door College. Los Angeles: UCLA School of Education, Junior College Leadership Program, Occasional Report No. 9, January, 1967.

[2] Robert F. Mager, "Terminal Behavior Objectives," in Preparing Objectives for Programmed Instruction. San Francisco: Fearon Publishers, 1961; "Terminal Behavior Objectives," in Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, ca. 1962.

[3] David Allen, William K. Bowers, Alvin Gorenbein, and John M. Meyer. A National Study of the Aviation Mechanics Occupation, Interim Report, Part II. Los Angeles: Division of Vocational Education, University of California, and Bureau of Industrial Education, California State Department of Education, 1968.

Meaningful student performance goals are stated in terms of expected student behavior at the end of the learning period. When these goals are precisely stated and have been made available to the student, he is more likely to be able to perform in the manner desired. Tests and other means of evaluation of the student's progress tell both the instructor and the student to what extent both have been successful in achieving the student performance goals.

To be precise, student performance goals must:

(1) Describe what the learner will be doing at the end of the instructional period, i.e., the learner will:

Write
Recite
Identify
Differentiate
Solve
Construct
List
Compare
Contrast
Assemble
Paint
Draw
Shape
Operate
Etc.

(2) Describe the conditions under which the student will perform, i.e.,
"Without reference to outside materials . . ."
"With the aid of the textbook . . ."
"Given a list of . . ."
"In the laboratory . . ."
"In a thirty-minute time period . . ."

(3) Present criteria of successful performance by the student, i.e.,
"With 80% accuracy the student will . . ."
"The student will identify 8 of the 10 characteristics of . . ."
"The student will complete the job to manufacturer's specifications . . ."

In the actual writing of the student performance goals, a succinct and concise statement is written that relates to the three listed student performance goal areas just discussed. The level of instruction assists in the determination of writing what the student will do and the conditions under which it will be done, and establishes the limit for the minimum acceptable performance (the criteria aspect of the student performance goal).

Once a student performance goal has been written it is possible to determine the approximate level of instruction. The reader may like an opportunity to review several student performance goals and check his opinion concerning the classification of student performance goals in relation to levels of teaching. Below are some student performance goals, with a blank for insertion of a numeral to indicate the level implied in each. Enter the teaching level for each statement.

Student Performance Goals

A. (Teacher Training)

From memory and without reference materials, to list, within two minutes, five major kinds of information necessary for pre-assessing students. __________

B. (Teacher Training)

To adapt a chart, which will be given to you in blank form, so that it will show, with the minimum of record-keeping, actual student progress in your course, in comparison with planned progress. __________

C. (Teacher Training)

In your school, to inventory the equipment and materials for your course (a) in sufficient detail to support insurance claims in case of fire or other loss, and (b) to use as a guide for timely additions and changes. __________

D. (Auto Mechanics)

To sharpen a twist drill to the proper specifications in ten minutes, and to demonstrate its sharpness by drilling a hole in mild steel within the time specified in a reference chart. __________

E. (Auto Mechanics)

Repack front wheel bearings of an American built automobile in thirty minutes, removing the assembly, cleaning the bearings, packing the bearings, replacing the assembly, and making the proper spindle nut adjustment. __________

F. (Auto Mechanics)

To answer correctly 16 of 20 multiple choice questions on frame design and construction, without reference material. The questions will include types of frames, types of construction, materials used for construction, unitized body and frames. __________

The proper identifications of the levels, by the identification letters given above, 1 being low and 3 high, are: A-2, B-1, C-3, D-2, E-3 and F-1.

The reader should recall that the student performance goals are established through predetermined levels of instruction. Thus, the above exercise for estimating levels of instruction may identify a cause for misinterpretation, if one reads a student performance goal without having prior knowledge of the anticipated level of instruction. Instructional materials (known as instructional packages) being developed by trade-technical teachers in California contain both the student performance goals, and a numerical notation of the expected level of instruction beside each goal. In addition, their instructional packages contain information related to instructional materials to be presented; but, even more important, they contain the various feedback activities from the student to the instructor to assist in continual evaluation of the instructional progress being made by each of the students. The individualized multi-media system utilizes the principles of the instructional packages, i.e., student performance goals, levels of instruction, presentation items, feedback activities, and evaluation. The multi-media system, however, is only one part of the total learning activity described in the instructional packages.

THE INSTRUCTIONAL ENVIRONMENT

Individual Student Assistance

After the student performance goals have been written and classified by levels of instruction, a determination is made regarding those goals that can best be met by such individualized instruction as use of filmstrip and audio tape. In most trade-technical courses, there is considerable material that is traditionally taught by lecture. With the multi-media system, much of this is learned by the individual student in the student study booth in the classroom adjacent to the shop or laboratory — at the time when he needs it most. Since it becomes unnecessary for the instructor to spend much time lecturing, this time saved can in part be used for individual student assistance. Such instructional assistance includes helping with independent study projects for students who have special interests, or who are ahead of their fellow-classmates. Such students

Student Study Booths in Auto Shop

can use special projects so that they can learn in greater depth or breadth or, in some circumstances, so that they can progress more rapidly toward completion of the course, and job placement. In other cases, the instructor helps the student with special remedial work so that he can keep up with the majority of the students. No matter how carefully the media are prepared, it is inevitable that some students will need assistance at some time with the individualized instruction; the instructor should be near by so that he can furnish the help needed. Personal counseling or advisement often can be provided by an understanding trade-technical instructor who has time available for this service.

Student performance can be properly evaluated only by the instructor, on the basis of observation of the individual student. These examinations can be conducted more frequently with this system. The fact that the use of individualized filmstrips and audio tapes also provides the instructor with extra time which he can use, at least in part, to assist individual students, seems to be one of the multi-media system's strongest advantages.

Small Group Discussion Method

Time which the instructor spent in lecturing in the traditional course can be used, in part, for teaching students in small groups. Although classes in trade and technical education generally are small, when compared with the average academic classes in the same school, there still are occasions when small group instruction (for 6 to 15 students) is most advantageous. Certain demonstrations can be performed by the instructor for a few students, who can see the details of the demonstration and can ask questions, and who can be asked questions by the instructor so that the latter can assure himself that all students can meet the goals for that lesson. The discussion of work habits and attitudes is more appropriately conducted in small groups, where the instructor starts the discussion and occasionally asks questions to guide the discussion, and where the students interact to each other's ideas.

In some small groups, instructors have given students opportunities to clarify learning problems encountered with homework assignments. Other small groups have been formed and utilized because of learning problems unique to those students, much as reading groups are formed and used by the elementary-level teacher.

Whole Class or Large Group Instruction

In addition to individualized instruction for each student at his own study booth, with the instructor giving students individual assistance as well as conducting small group instruction, a comment about whole class or large group instruction seems to be in order. Large group instruction is used by the instructor to arouse the enthusiasm of the students for a new unit or for a new process which they are about to study, or to hear a report on the success of last year's graduates, etc. Since few schools are equipped for individual use of sound motion pictures, these will most generally be utilized by the instructor with the large group. Outside speakers, certain demonstrations appropriate for the whole group to see, and written tests, are all activities which can profitably be scheduled for whole class or large group instruction.

Evaluation of Students on the Basis of Stated Goals

Students under this system must be evaluated on the basis of attainment of student performance goals. This evaluation may take the form of check-up quizzes after individualized filmstrip and tape have been used. It also may take the form of performance tests for jobs or operations done in shop or laboratory. Examinations at mid-term time and during final examination week take the form of complete review and testing of what the students have learned over longer periods of time, and determination of whether they not only can recall the material they have learned, but also whether they can utilize it in a different framework and under precise criteria established by the performance goals.

Teachers of trade-technical education have unusual opportunities to evaluate the work of their students with lifelike jobs, so that their performance can be rated against the student performance goals that were established for this class. It is important for the trade-technical teacher to remember that students are expected to perform only up to the level of the goal that was established. If students were told they had to learn a skill to Level 2, and then were tested on the basis of their ability to perform that skill at Level 3, the instructor would have been in error. One of the distinct advantages of the multi-media system is that the instructor has established clearly and distinctly the performance goals and the levels to which he intends to teach each of these goals; he then tests to determine whether every student has performed up to the specified level for each goal.

Evaluation of the Course Content, Media, Methods, and Goals

By checking his evaluation records, the instructor can determine whether students have attained the performance goals initially established. Instructors are encouraged to seek assistance in determining whether the original student performance goals were satisfactorily met, and in determining the extent to which future students can be helped more effectively to achieve these goals. Helpful sources of guidance are the placement officers in the industries where the instructor sends the majority of his students. They may or may not serve on the advisory committee, but a conference with them, particularly several months after students have been placed, should be very useful to the trade-technical instructor.

Student evaluation of the course, if given anonymously through the use of student "opinionnaires," also can be helpful. Students who have gone through the training program and are currently working will be among the instructor's most reliable sources of evaluation. Some instructors working with the multi-media system have asked instructors in other institutions to review a list of their student performance goals and certain of their media; believing that such teachers would be more likely to view the materials objectively, the senders have asked for frank appraisals. The Mt. San Jacinto College staff has worked out an arrangement with Los Angeles Trade-Technical College whereby the multi-media materials developed by instructors at the former institution are judged by instructors at the latter school, who provide critiques of their effectiveness.

Advisory committee members also are utilized at every opportunity to review the student performance goals and, from time to time, to view the multi-media instructional materials and see if they have suggestions for improvement. Committee members also may be shown the extent to which a recent graduating class has achieved the established performance goals, and they may advise the instructor as to whether the goals were appropriate or whether something should be altered in the course material to improve instructional effectiveness and efficiency for the next group of students.

Since an instructional system must be methodically reviewed and validated in order to meet established student performance goals, these suggestions indicate some current methods for revising and improving the educational program to meet established student performance goals. Evaluation is a critical part of the instructional system. Every effort must be made to constantly seek and utilize more precise methods of evaluation.

CHAPTER III

THREE EXAMPLES OF MULTI-MEDIA UTILIZATION

The utilization of individualized multi-media instruction in trade-technical education programs has been on a limited scale. As more teachers become trained in the techniques of production and use of multi-media instructional systems, there should be an ever increasing number of trade and technical programs incorporating individualized multi-media instruction within their curriculum offerings.

Beginning in 1963, as a newly established college holding its first classes, Mt. San Jacinto has actively sought to adapt the newest educational technology to both its general and its vocational programs. The staff has been encouraged to design and develop original teaching media and to experiment with methods of using them. The first courses at this college to utilize these new methods included Health Education, Remedial English, American History, Shorthand, Typing, Sociology, Music Appreciation and Music History.

A cooperative effort between the California State Department of Education, Bureau of Industrial Education; Division of Vocational Education, University of California; and Mt. San Jacinto College has resulted in experimentation and the development of programs in individualized multi-media instruction for Trade-Technical Teacher Education, and courses in both Auto Mechanics and Auto Body and Fender Repair. The teacher education individualized multi-media planning involved both the trade-technical teacher education staff, Bureau of Industrial Education, located in the Division of Vocational Education, University of California, and the appropriate staff and technicians of Mt. San Jacinto College. The planning and production of individualized multi-media for Auto Mechanics and Auto Body and Fender was developed through certain members of the staff of Mt. San Jacinto College.

The remainder of this chapter describes the development of the teacher education program and the background of the Auto Mechanics and Auto Body and Fender classes which are operated under provisions of the Manpower Development and Training Act (Public Law 87-415). Brief examples of multi-media audio script, accompanying filmstrip photos and workbook content follow the discussion and description of each of the three programs. The teacher education discussion presents additional background information so that the reader may gain a greater appreciation of the scope of the program and the rationale for the implementation of individualized multi-media instruction in trade-technical teacher education.

Chapter III

TRADE-TECHNICAL TEACHER EDUCATION

Program Development

The need for professionally trained teachers for vocational education programs has long been recognized. Effective preparation of teachers for vocational education has emerged as one of the strengths that reinforce the success of the students graduating from these programs, thus furthering the purposes and objectives of vocational education.

Improvement of the trade-technical teacher education program has accelerated through the years. The challenge for improving the teacher education program has been reflected in renewed and expanded efforts. Revision and adaptation of course content have kept pace steadily with new educational processes. Inherent in the program development has been the element of flexibility and the willingness to experiment, thus permitting the development of unique programs.

Over the 50-year period since passage of the Smith-Hughes Act, the trade-technical teacher education program in California has increased by over 3,200 percent. Ninety-four students were enrolled in the trade-technical education program in 1918; this rose to some 600 students per year for the next 30 years. Over the succeeding 15 years, 1,000 prospective vocational teachers were trained annually; then, within the next five years, the number has increased to more than 2,000 per year. This growth has compounded the problems of providing a quality program to an enormously increased enrollment, as well as those of making training available throughout the large geographic area of the state.

The problem of logistics, coupled with improvement of the teacher education program, has resulted in the development of several patterns for trade-technical teacher education programs. The earliest development was an experimental "core" summer session training program at UCLA in 1961. This program has evolved into a series of 24 sessions, spaced over a two-summer period; 12 sessions are offered the first summer as "Core 1," and 12 sessions the second summer, as "Core 2."

The core program is made up of nine major subject content areas. These areas relate to (1) the student, (2) the instructor, (3) instructional media, (4) instructional processes, (5) evaluation, (6) instructional management, (7) facilities, (8) community relationships, and (9) scope and function of vocational education.

The program is so designed that subject content and activities are introduced and spiralled through the program, giving continuity and emphasis, to develop more effective trade-technical instruction. During the entire summer session core program, emphasis is placed on small group interaction and individual performance. The team teaching technique also is utilized, with two team members serving as teacher assistants as one member is teaching. This permits reciprocal daily critiques of performance, and aids in maintaining coherence between the teachers' instruction as well as assisting each teacher to improve his presentations.

Experiments in Trade-Technical Teacher Education

Increased federal assistance to vocational education during recent years has swelled the numbers of vocational classes in California, as elsewhere. New programs and classes, in addition to the established programs, have made heavy demands for an ever increasing number of teachers. To train the large number of new trade and technical teachers, it has been necessary to utilize mass methods. Thus, it was reasoned that individualized multi-media instructional techniques can be applied to vocational education; however, the approach must first be used in teacher training. There is a recognized tendency of teachers when they are instructing students to follow the approaches used in their own professional training. It has been believed, therefore that teachers who have actually had the experience of using new instructional methods and techniques will be more likely to use them in their own instruction.

An experiment in on-the-job training of trade-technical teachers was undertaken in 1966 at Mt. San Jacinto Junior College to determine whether such training would result in the successful incorporation of multi-media instructional materials and techniques into the participants' ongoing instructional programs. A group of teachers of teachers of Manpower Development and Training Classes was taught by a team of teachers. The Manpower Development and Training teachers had their teaching performances recorded on slides and audio tapes for analysis. In this experiment, classroom experiences in teacher education paralleled program content of the regular University of California summer session Core I classes. Modifications were made to better tailor instuctional content to the needs of those enrolled in the program. These modifications were primarily in line with the ongoing summer session programs; changes occurred only in sequencing and emphasis.

A second experimental program was conducted during the Spring of 1967 at Mt. San Jacinto College. This class, too, was primarily for teachers of Manpower Development and Training Classes. An industrial educator, with a background of audio-visual instruction and teacher training, was employed in producing individualized multi-media instructional materials. He received assistance from the staff available at the college. He also had the use of the facilities for developing and reproducing the various components of the multi-media materials. The materials developed were designed to present the traditional content of the Core I summer session class. Students in the second experiment met on Saturdays for formal large group presentations as well as small group discussion activities. Video taping was used to record the enrollees in their own teaching assignments. These tapes were analyzed with the instructor and enrollee in order to assist them in improving their instructional ability. An evaluation although meager in scope, of both the Spring and Summer session 1967 experimental classes is discussed in Chapter 5.

A third phase of experimentation is now in progress. This phase is concerned with revising and improving multi-media instructional materials now on hand and to extend the coverage through the production of many new film strips, audio tapes and worksheets. A listing of the multi-media being developed can be found in the Appendices.

As a result of research and experimentation, a new but compatible program now is evolving in an effort to provide services to teachers living in the many outlying geographic regions of the state. The general goal is to develop individualized multi-media instructional material for a system of professional preparation of new trade-technical teachers. This will permit many teachers, upon leaving industry, to begin their teacher education simultaneously with their teaching duties. Teaching principles and practices will be applied directly to their instructional requirements. Their course work will contribute directly to the organization and teaching of their classes. These teacher education classes are scheduled in various urban communities to meet the convenience of those enrolled.

This new program incorporates four activities: (1) large group presentations, similar to the summer session core; (2) individual multi-media study; (3) small group discussions which introduce, amplify, and review subject content and multi-media workbook activities; (4) video taping and/or photographing of teacher presentations in their own instructional areas.

This newly developed teacher education program takes advantage of multi-media and adapts it to the professional preparation of trade-technical teachers, at the same time incorporating salient features of the core program. The plan for this particular program requires a few spaced "whole class" meetings over the period between September and May. In addition, there are class meetings of the teachers in their own communities, held at a school site, at which time discussions regarding multi-media assignments are held and the distribution and collection of multi-media instructional materials and other related activities takes place. This program is an alternate to the summer session core programs. An individual may enroll in the programs in his own geographic location, or in the summer session cores, or in any combination thereof.

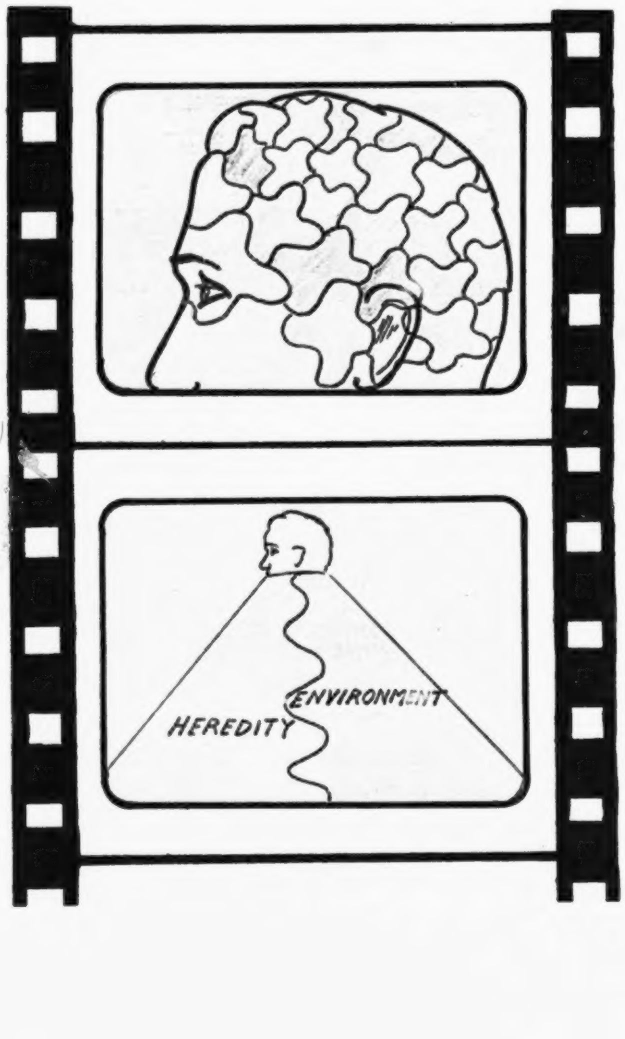
It is hoped that through this type of compatible program in trade-technical teacher education, the teacher education needs of each individual can be better met. Thus, trade-technical teacher education in California will become a dynamic entity. An example from a multi-media lesson follows:

Example of Script and Accompanying Filmstrip

The Instructional Process in Vocational Education

The Student as an Individual

(Filmstrip Frames) (Text of Audio Material)

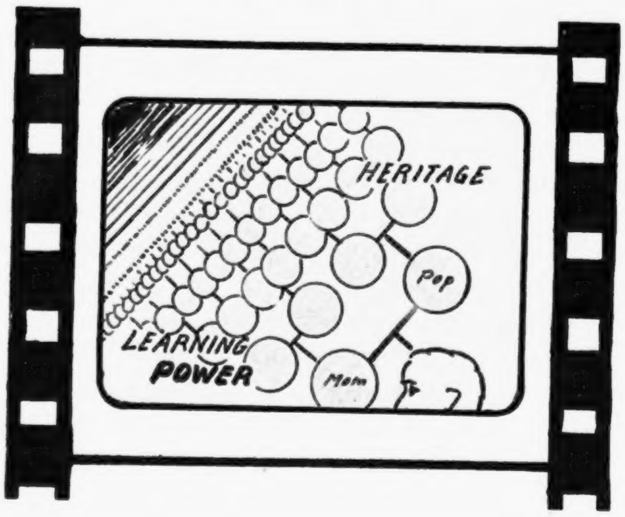


Learning is a complex process, in large part psychological but also physical, social, and even economic.

The psychological bases for learning are supplied by (1) heredity and (2) environment.

Complete statement No. 2 on your worksheet. (Pause)

Of course, the answers are "heredity" and "environment."



Heredity from parents and ancestors is transmitted to an individual through genes which shape his learning potentials and characteristics. He inherits undeveloped abilities. He does not inherit knowledge, skill, or conditioned attitudes. These must be learned.

Answer Question 3a. (Pause)

You should have responded with "learned."

Primary needs, drives, or instincts which are inherited include hunger and sex.

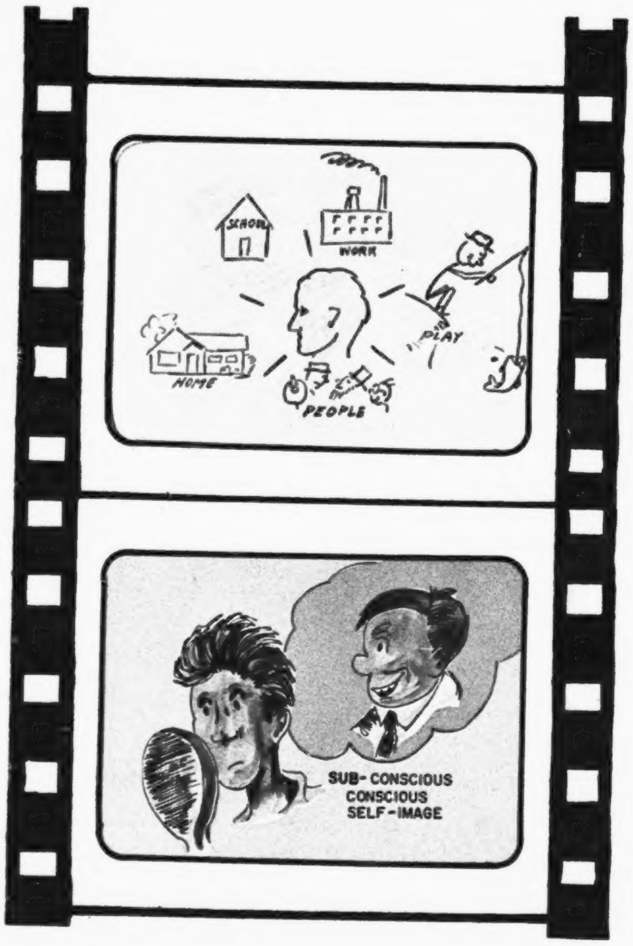
Answer Question 3b. (Pause)

The correct response is "inherited."

Some needs which seem to be entirely learned include the need for recognition, love, and self-actualization.

Answer 3c. (Pause)

Your answer should be "learned."



These inherited and acquired or learned needs, drives or tensions are interrelated in ways not completely understood.

The individual's development occurs in his environment and is conditioned by it or by his experiences within it. School is a part of this environment, perhaps the minor part, since much more time is spent out of school than in it.

Answer Number 4. (Pause)

Your answer should be "environment."

Through interaction with his total environment, the individual develops his self-concept. A significant conditioning can be brought about by education, but the way one sees himself as well as other things in relation to himself is a critical factor in the process of "self" development.

Complete Statement 5. (Pause)

The missing word is "self."

Chapter III

Example of Worksheet

The Instructional Process in Vocational Education

The Student as an Individual

This lesson is about the nature of the student, the needs and wants which push him, and some practical means of identifying and using his goals and needs in your teaching.

The filmstrips on Individual Differences and Measuring Differences and the instruction sheets on Test Data Interpretation and How to Make A Profile supplement this lesson.

Your performance goals are:

1. To identify and write from memory eight or more of ten kinds of motives for individual actions.
2. To describe in writing common effects, both positive and negative, on the individual of barriers to his motives and success or failure in surmounting them.
3. To analyze quickly a student's transcript of record to a degree helpful in predicting (1) his success in training and (2) special educational needs related to his training.

Proceed with the filmstrip and tape. It is suggested that you take notes, particularly of the types of individual motives mentioned.

1. An individual is basically a product of ____________ and ____________.
2. Knowledge, skill and attitudes are ____________ rather than ____________.
3. Physiological needs such as hunger or thirst for food and water are ____________ through experience.
4. School is part of an individual's total ____________.
5. School plays a part in shaping an individual's ____________ concept.

TRADE-TECHNICAL EDUCATION FOR THE AUTOMOTIVE TRADES

Program Development

The County Automotive Trades Advisory Committee, called together by the California State Department of Employment, identified those job classifications in the auto repair field in which there was a shortage of skilled men. The Mt. San Jacinto College staff drew up general objectives for two proposed training programs and submitted these for approval to the local advisory committee. The next step was to employ competent tradesmen who also qualified as credentialed instructors and to train them in the skills of preparing multi-media materials. This preparation period included their reading Robert F. Magar's "Preparing Instructional Objectives,"[1] Peter Piper's "Preparing Programmed Instructional Materials,"[2] and Samuel Postlethwait's "An Integrated Experience Approach to Learning."[3] They also viewed and listened to individualized filmstrips and audio tapes that had been preparedby teachers of academic subjects who had used the multi-media system for a year.

The teacher-authors assigned to the two automotive programs — Auto Mechanic, and Auto Body and Fender — talked at length with teachers and administrators who had experience with multi-media techniques to learn from their successes and mistakes. Special help was given to automotive instructor-authors on the writing of specific student performance goals. While these goals were being formulated, all available sources of filmstrips and accompanying scripts were being investigated to discover if suitable materals were available commercially.

The student performance goals were written and analyzed to determine which could best be met by obtaining or producing individualized multi-media material. The appropriate commercial filmstrips were requested for preview. The major auto manufacturers in the United States proved to be a rich resource for usable filmstrips. After previewing many of their filmstrips and accompanying transcriptions, it was found that all available filmstrips were designed for "whole class" use, and that scripts included only infrequent checkup questions.

Permission was sought and obtained in writing from each of the automotive manufacturers to use the copyrighted material in any way the college desired, including combining the filmstrips with locally developed modified programmed scripts recorded on audio tapes. Use of the copyrighted material was granted conditionally, requiring (a) that appropriate credit be given to the copyright owner and (b) that the modified media be used only at the institution making the request.

A number of subjects for which filmstrips and audio tapes were needed were in areas where no appropriate commercially made materials could be found. Related instruction lessons in these areas were then carefully considered for possible inclusion in the planning for instructor-designed filmstrips and coordinated audio tapes. A listing of individualized multi-media lessons appears in the Appendices.

Operation of Auto Mechanics and Auto Body and Fender Classes

At Mt. San Jacinto College the related instruction classroom for Auto Mechanics is adjacent to the auto shop and connected to it by a common door. The study booths are installed at the back of the room. Each is equipped with a filmstrip projector, a tape recorder with earphones and a writing space for the students to use when answering the worksheet questions. The Auto Body shop is arranged similarly, except that the students' study booths are located in one end of the shop, as is the classroom area. Arrangement of the study booths in relation to the shop and the related classroom area make it possible for students to use the individual booths either during shop time or during times when part of the class is working with the instructor as a small group.

---

[1] Robert F. Mager. Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, ca. 1962.

[2] Peter Pipe. Practical Programming. New York: Holt, Rinehart and Winston, 1966.

[3] Samuel N. Postelthwait et al. An Integrated Experience Approach to Learning. Minneapolis: Burgess Publishing Co., 1964.

It is possible to use the multi-media materials as they become needed. For example, when a student in the shop is assigned a job which, for the first time, requires him to set up and light a welding torch, he can use the multi-media lesson on this subject. He can then follow the recommended procedure and get checked out by the instructor. The instructor does not have to give a repetitious set of information statements or teach a lesson on the subject to the whole class days or weeks before the last student has his turn with the torch.

In addition to the use of multi-media materials, the instructional program in these two trade classes includes textbooks, job and procedure sheets, small group discussion sessions, individual sessions, and large group sessions where a few instructional motion pictures are used, motivational talks take place, and tests are given. In addition, and as the pricipal element of the instruction program, students do repair jobs on laboratory component units and on appropriately selected "roadable" cars.

One of the features of the individualized self-pacing instruction is that some students (over 18 years of age) are moving ahead of the others in class; they will have completed the course and be able to enter employment before the year is over. Because of the individualized feature, vacancies in the classes can be filled by new students without waiting for a new term. Examples of a few filmstrip frames for Auto Mechanics and Auto Body and Fender, designed by the class instructor, with accompanying scripts for tapes and corresponding student worksheets follow:

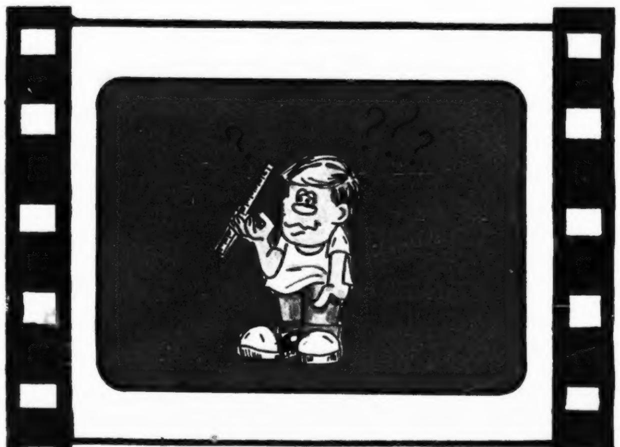
Example of Script and Accompanying Filmstrip

Automotive Mechanics

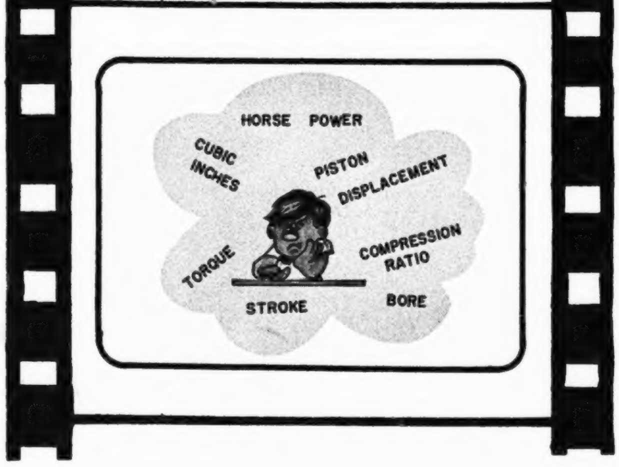
Engine Power And How It Is Rated

(Filmstrip Frames)

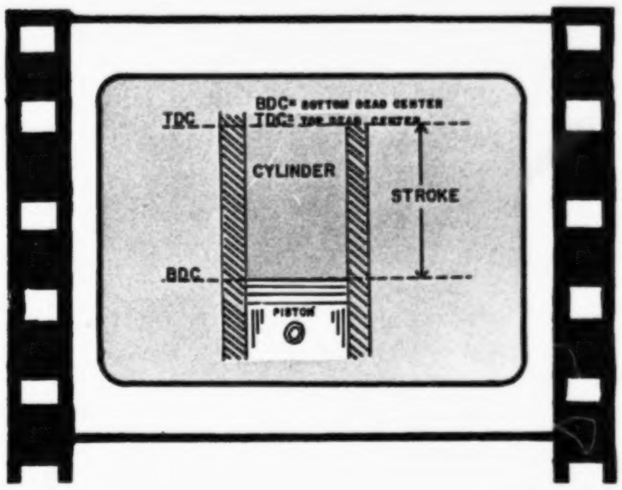
(Text of Audio Material)



We live in a world of measurements. Everything we buy or sell involves some kind of measurement. The automobile, to the confusion of many of us, has many different types of measurements, such as horse power ratings, both SAE and brake; torque, piston displacement, cubic inches, compression ratio, bore, and stroke. Also, there are many types of measurements which attempt to determine engine efficiency, such as mechanical, volumetric, and thermal.



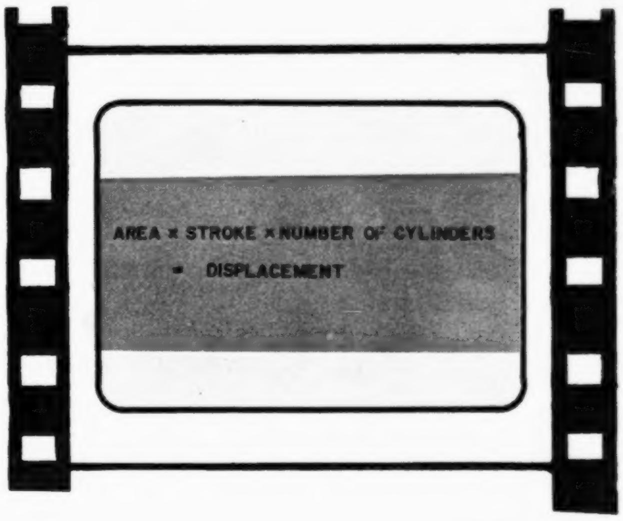
Not all of these are vital to the automotive mechanic; however, the more we know about the automobile, the better equipped we will be to handle the problems of repairing it. In this filmstrip and tape, we will endeavor to give you at least a definition for the important measuring terms used on the internal combustion engine.



The most basic engine measurement is piston displacement. The picture on this frame shows a cross section of a piston and cylinder. At the top of the cylinder is a dotted line that indicates top dead center, or the highest point of travel, for the top of the piston. Near the bottom of the cylinder is another dotted line indicating bottom dead center, or the lowest point of travel, for the top of the piston. The distance between these two lines is the length of the piston stroke. As the piston moves from bottom dead center to top dead center, the top of the piston pushes the air ahead of it, and out of the cylinder.

Please stop the tape while you answer Question Number 1 on your worksheet. (Pause)

The correct answer is the "piston stroke."



AREA x STROKE x NUMBER OF CYLINDERS
= DISPLACEMENT

We can then say that piston displacement refers to the amount of space through which the top surface of the piston passes as it moves from bottom dead center to top dead center. Thus, total piston displacement is easily calculated by using this simple mathematical formula, AREA X STROKE X NUMBER OF CYLINDERS = DISPLACEMENT.

Under Item Number 2 on your worksheet, fill in the blanks on the formula, using the specifications listed below the formula.

The correct answer is "12.55 X 3.25 X 8 = 327 cubic inches."

Example of Worksheet

Automotive Mechanics

Name: ______________________ Date: ______________

Filmstrip and Tape: Engine Power and How It is Rated J-2.

Reading Assignment: Chapter 4, pages 49-60, Automotive Mechanics, by William H. Grouse.

Performance Goals:

Given data on piston number, diameter and stroke, to calculate displacement to the nearest cubic inch.

To calculate engine horsepower by SAE formula to the nearest whole unit, and to explain the difference between formula and brake horsepower.

To show, by freehand diagram with notes, what is meant by a 10:1 compression ratio.

1. The distance between bottom dead center and top dead center is the length of the ____________

______________.

2. Area X Stroke X Number of Cylinders = Displacement.

____________ X ________ X ________ = 327 cubic inches.

1967 Chevrolet V-8 Specifications

Bore = 4 inches
Stroke = 3.25
Area = 12.55 square inches.

Example of Script and Accompanying Filmstrip

Auto Body and Fender Repair

Oxyacetylene Welding

(Filmstrip Frames)

(Text of Audio Material)

The purpose of this filmstrip and tape is to show the proper procedure for setting up the oxyacetylene welding equipment and how to weld a bead.

We have already discussed the equipment and the safety precautions necessary for oxyacetylene welding. Our next problem is learning how to set up the equipment and how to light the torch.

In assembling the welding equipment, there are certain things that must be done if you are to protect yourself and the equipment you use.

The first step in setting up the equipment is to chain the welding cylinders to a two wheel welding truck, or some other object that cannot be pushed over.

Please stop the tape and answer question number one on your worksheet. (Pause)

The answer is "chain."

Before the regulators are attached, the screw threads and the connection seat should be inspected for damage. A damaged screw thread could ruin the regulator, while a bad seat could cause a dangerous gas leak.

Please stop the tape and answer Questions Number 2 and 3 on your worksheet.

Question 2 should be completed with the words, "screw threads," Question 3 with, "dangerous gas leak."

Example of Worksheet

Auto Body and Fender Repair

Name:______________________________ Date:____________________

Filmstrip & Tape: Oxyacetylene Welding C - 5

Reading Assignment: None

Student Performance Goals

1. In written tests, to state from memory and in proper sequence the six major steps in setting up an oxyacetylene welding outfit, adding the necessary cautions to be regularly observed in each step.

2. Given a welding exercise in the school shop, to set up, regulate, light and adjust the oxyacetylene equipment in 5 minutes, observing all regular safety precautions and being ready to start the weld with the correct tip, flame, rod and flux.

PROGRESS CHECK

1. Welding tanks must be secured with a ____________ to a welding truck or wall before they are safe for use.

2. A damaged ____________ ____________ could ruin the regulator.

3. A bad connector seat could cause a ____________ ____________ ____________.

CHAPTER IV

TECHNIQUES FOR LOW-COST PRODUCTION OF INDIVIDUALIZED MULTI-MEDIA INSTRUCTIONAL MATERIALS

The financial expenditures required to teach a class of students skills and technical knowledge up to a determined performance level is generally unknown. It is difficult to determine what a specified amount of learning for a given number of students will cost, and thus, schools seldom conduct educational cost accounting. It is obvious that hundreds of students can attend a class in a very large auditorium with one teacher who lectures to them, and the cost per student is less than any other except, possibly, in television instruction. It is doubtful, however, that the large group lecturing method assists students in achieving realistic performance goals. This is particularly true for students in trade-technical education classes.

Filmstrips have been produced for as much as a hundred thousand dollars for one filmstrip, and they also have been produced at a very nominal cost of a few dollars, where instructors have designed and produced them in a short period of time. This chapter will describe the utilization of low cost equipment and shortcuts in production of both filmstrips and audio tapes, in order to produce individualized multi-media instructional materials within an inexpensive price range.

It is currently believed, on the basis of limited experience, that nearly all successful teachers in trade-technical subjects are capable of learning the skills needed to plan and design filmstrips and audio tapes. Notice that the words "plan" and "design" have been used, because it will generally be necessary for nearly all teachers to have the technical assistance of a photographer, a sound technician, and a commercial artist, or at least a student artist, to produce satisfactory filmstrips and tapes for individual student use. Teachers need to be assisted in the skills which a programmer uses in developing programmed instruction, and they require some assistance as they consider the visual materials which they propose to have included in the filmstrips. Such assistance has been provided by special supervisors or qualified administrators, or by employed or volunteer special consultants.

As teachers become accustomed to their roles as designers of media, their speed of production as well as the quality of production increases. It can safely be assumed that the first summer an instructor works on the production of multi-media, the process will be a slow and tedious one, but as he progresses and gains confidence, the skills that he acquires tend to increase the quality and quantity of his production.

Chapter IV

Script Preparation

Developing a coordinated set of individualized instructional materials including filmstrip, audio tape and duplicated worksheet, all following a modified programmed instruction format, can be a challenging and worthwhile experience for the writer-designer. Effectively made media will enhance the student's rate and depth of learning and provide the instructor with the satisfaction of a teaching job well done. The results of careful and thorough planning by the instructor can be seen and heard by anyone who has the interest and takes the time to see and hear them. The pride of authorship can be a significant supplemental reward for the teacher-writer-designer.

It is usually necessary to provide instructors with sufficient released time from their regular duties so that they can prepare the scripts for the individualized multi-media instructional materials. These scripts establish the filmstrip content and sequence, and the wordage for the coordinated audio tapes and the accompanying worksheets. Initial development begins with reviewing existing course outlines, objectives and goals, and the content of each topic taught. Obsolete or unneeded content should be eliminated and new content added. It is advisable that the revised course content be reviewed by an administrator and an advisory committee. When possible, review by other instructors of the same subject working at other schools can be of great assistance. The instructor should then select instructional content which can be most appropriately taught by the use of filmstrips, coordinated audio tapes, and accompanying worksheets.

A procedural outline for script development should include the following listed steps, in the sequence as given:

Step 1. Identify the topics that will be taught by the individualized multi-media system.

Step 2. Establish levels of instruction identified through an occupational analysis or through the assistance of advisory committee members and/or industrial consultants.

Step 3. Develop a list of questions, problems, and/or skills that the proposed media are expected to enable the student to master at the end of instruction. These questions and activities are established at the level of instruction identified in Step 2. The questions should be so comprehensive that the student learns little else except what is included in these check-up activities. Questions can include such evaluation devices as drawing circuits, diagramming, drawing a sketch, or assembling a kit.

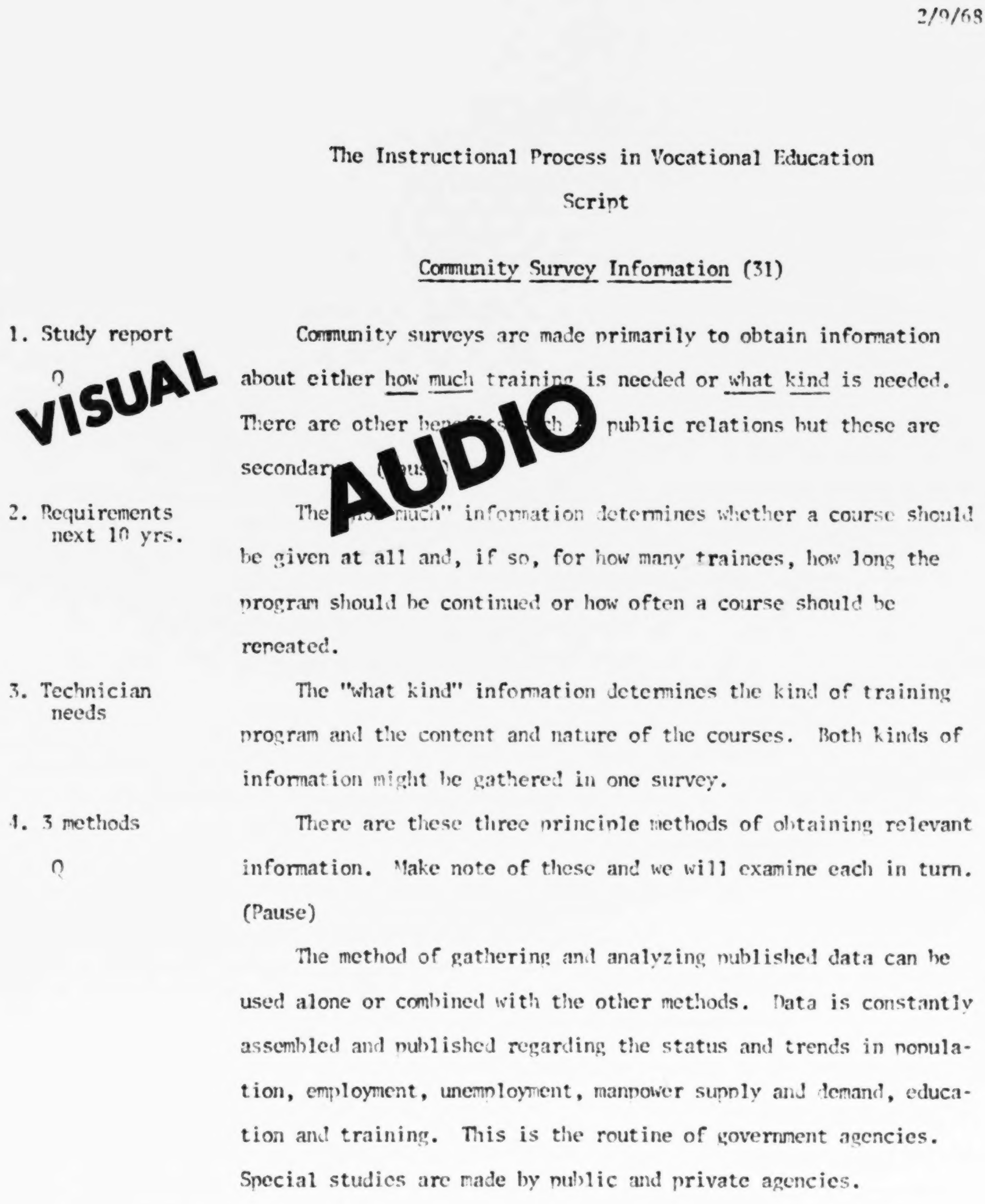
Step 4. Write specific student performance goals that identify what the student will be able to do at the end of the instructional period, the conditions under which the student will perform, and the criteria of acceptance for successful performance by the student.

Step 5. Review the questions and activities identified in Step 3 and the student performance goals developed in Step 4 with other teachers who are knowledgeable of the subject, advisory committee members, consultants and/or supervisors, to help verify the completeness and appropriateness of the questions and activities as well as the student performance goals.

Step 6. Prepare the script for the audio tape by assuming you are talking to one student in an informal manner, as you would if you were tutoring a student on this subject.

a. Consider the first question and teach your hypothetical student all that he needs to know so that he can answer the question correctly.

b. Plan the verbal script, the visuals and the worksheet material together, as one coordinated learning experience. Leave a two-inch margin at the left and insert the filmstrip



2/9/68

The Instructional Process in Vocational Education

Script

Community Survey Information (31)

VISUAL

AUDIO

1. Study report Q	Community surveys are made primarily to obtain information about either how much training is needed or what kind is needed. There are other benefits such [illegible] public relations but these are secondary. (Pause)
2. Requirements next 10 yrs.	The "how much" information determines whether a course should be given at all and, if so, for how many trainees, how long the program should be continued or how often a course should be repeated.
3. Technician needs	The "what kind" information determines the kind of training program and the content and nature of the courses. Both kinds of information might be gathered in one survey.
4. 3 methods Q	There are these three principle methods of obtaining relevant information. Make note of these and we will examine each in turn. (Pause)
	The method of gathering and analyzing published data can be used alone or combined with the other methods. Data is constantly assembled and published regarding the status and trends in population, employment, unemployment, manpower supply and demand, education and training. This is the routine of government agencies. Special studies are made by public and private agencies.

Sample of Script

frame number and a one- or two-word notation describing the illustration planned. Script preparation, filmstrip sketches and worksheets for students should be prepared together.

c. Ask the student the appropriate question and direct him to answer it on the worksheet.

d. Give the student the correct answer for confirmation. This can be done verbally on the tape, or visually on a filmstrip frame, or on another page of the worksheet.

e. Tell the student what to do if he did not get the correct answer; i.e., listen to the material on the tape until understanding is achieved, or i.e., read pages 501 to 505, Machinery's Handbook.

f. Present the next material to prepare the student so he can answer Question 2 by repeating the steps "a" thru "e". Seldom should these steps take longer than two to three minutes to teach before a check up question is asked.

g. Include in the script encouragements to the students to extend their learning about the subject area beyond the material provided, by suggesting one or more independent investigation activities. Remember to call on the students to report on their independent investigations.

h. Direct the student, when appropriate, to stop the equipment and perform some learning activity, i.e., measure the marked object with a micrometer, look up this subject in the encyclopedia, see microscope station Number 1, etc.

Some other suggestions for preparing scripts may be of benefit. The original script may be prepared in rough draft, either by writing it in longhand or by dictating it to a machine or a tape recorder. When a tape recorder is used, it is a great convenience to have a switch on the microphone for stop and go dictation, and a foot control and headphone for transcription by the typist.

The script should be typed in double spacing, with an extrawide left-hand margin — preferably at least two inches wide. The double spacing makes revision easier. It usually is necessary to make several revisions before the script can be taped. It is advisable to have someone other than the originator read the draft to check for clarity of ideas and expression.

After the initial draft, covering all essential content and explanation has been completed, the next step is to write the accompanying worksheet on which the student gives his responses. The more nearly the tape approaches the format of programmed material, including more frequent responses, the more effective the medium will be. It is necessary to tell the listener to answer a question, write the key word, select the probable cause or do something else in the way of response. The necessary pause for his reaction must be indicated in the script. If he must stop the recorder, he should be so instructed.

Following good programming technique, the student should be shown or told whether his response was correct.

Instructions, teaching content, type of response, and reinforcement must all be built into the script. The response sheet or worksheet must be coordinated with the script, with reference numbers to indicate definite location for answers, for ease of later checking. The necessary pauses must be inserted, particularly if someone other than the writer is to do the recording.

Although illustrations should have been selected during the writing and revision of the audio portion of the script, now is the time to insert serial numbers and illustration titles or notes, using the wide margin left for this purpose. Only a word or phrase is necessary to retain the idea of the illustration. These should be placed beside the portions of the audio-script to which they correspond.

As illustrations are sketched and developed, as described below, additional changes in the script may become desirable. For example, a picture may make some word description unnecessary, or the solution of a problem may be better presented in diagram form than in exposition. Changes of mind about the nature or number of illustrations often occur during development of the visual component.

The final script must include all changes. Even then, it still is necessary to indicate on the script the exact location of the sound cues for advancing the filmstrip to the next frame. One method of providing cues to the student is to use a bell or electronic oscillator sound for changes with the additional voice announcement of the frame number for the first and every fifth frame from No. 5 onward. These cues could be typed in the script, but red pencil checks are preferrable. Red numbers should be added to the check mark for the vocalized numbers.

Studio 96
A CHANNEL
B CHANNEL
AMPLIFIER
SPEAKER
ALTEC
AMPEX

Editing Audio Tape

Chapter IV

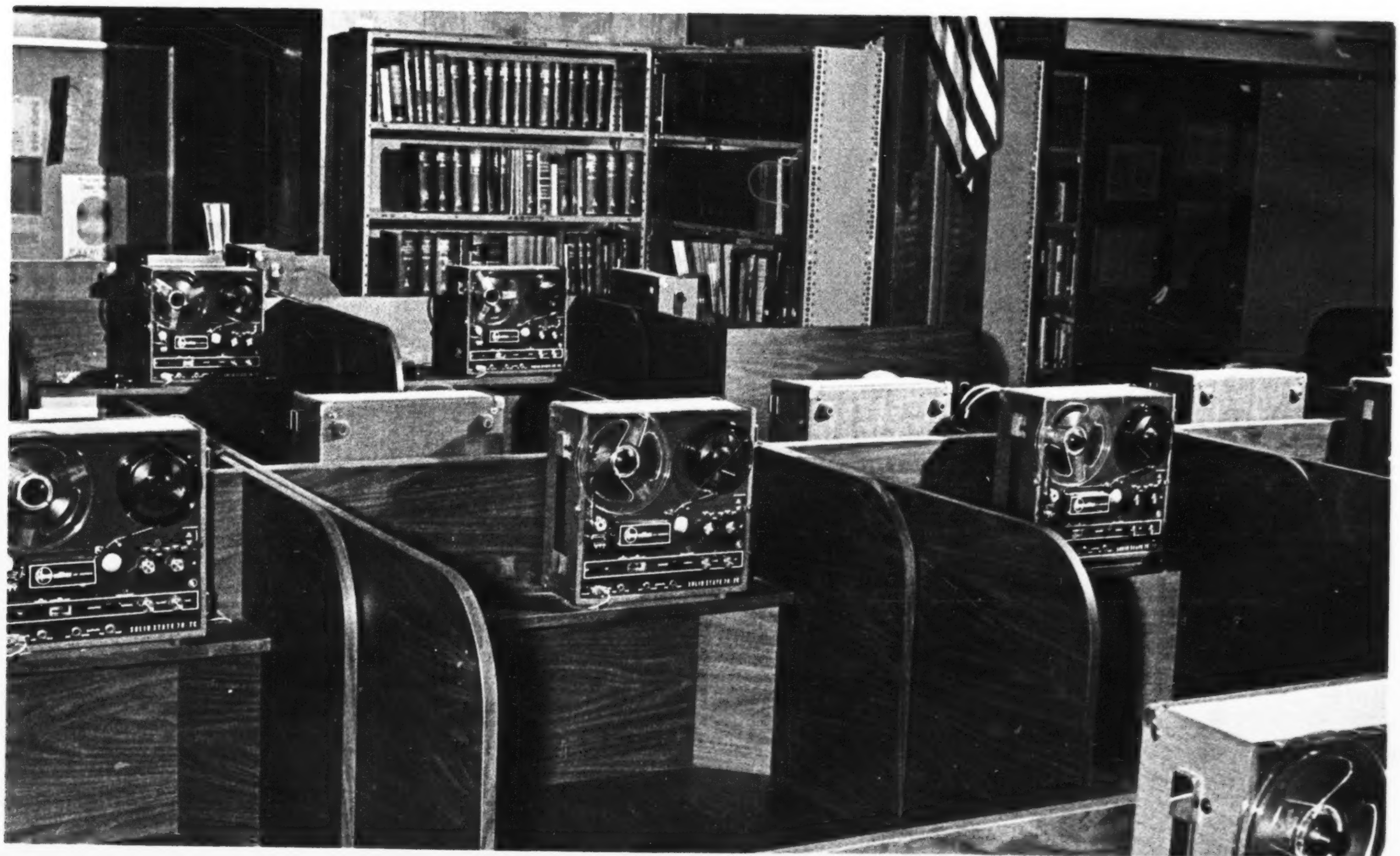
Audio-Tape Preparation

When the script has been cued, it is ready for recording the master copy. This is best done in a sound proof booth with a good quality microphone and recorder. The projects described here have been standardized for tape with speed of 3-3/4 inches per second for class use; the same speed is used for the master tape. This is adequate for voice reproduction. Music or sounds with greater frequency range would require tape of higher speed.

A trained reader, such as a radio announcer, will produce a better result than most teachers can. Most master tapes, however, can be made by the instructors themselves. The added quality of a professional voice must be weighed against the increased cost.

The master tape is edited by a technician to eliminate pauses, repeats and other errors and to add the audible cues as well as leaders to the tapes. The editor also regulates the volume for uniformity of sound level.

Duplicate tapes can be made on a tape duplicating machine, which produces several at a time. At Mt. San Jacinto College, 20 of the recorders in the study booths have been adapted for duplicating. Each recorder is loaded with a blank reel of tape, and the master signal is fed to all 20 simultaneously. The prints are then finished with leaders, boxes and labels. The academic college classes at Mt. San Jacinto use seven-inch reels, but five-inch reels have been adopted in the teacher training and automotive programs. These provide a half-hour of playing time in one direction; few tapes are longer than this. The reels can be reversed and the playback continued in the other direction, if necessary, because half-track recording is used. Savings are effected by purchasing large reels of tape and re-winding on small ones.



Multi-Media Study Center

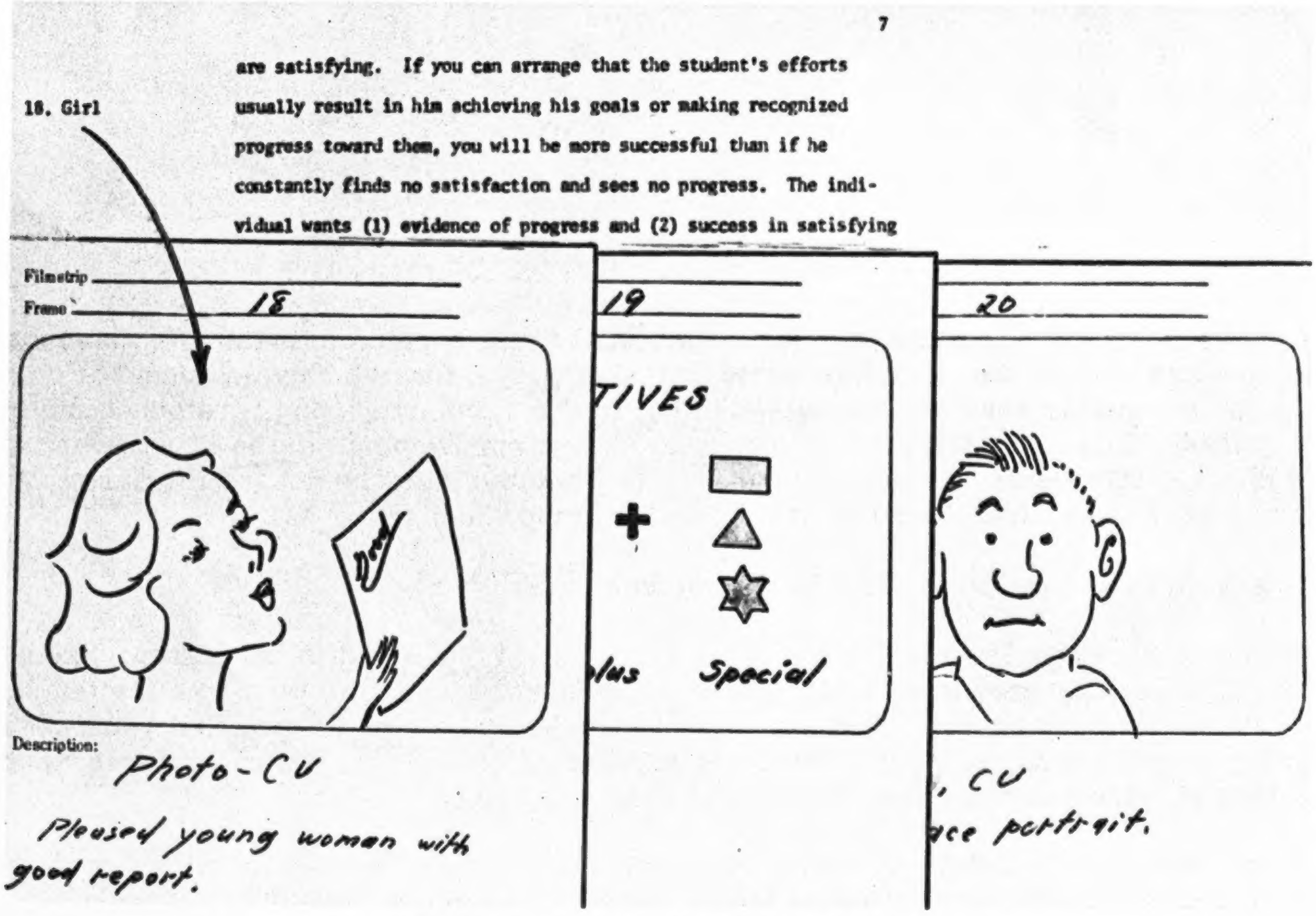
Filmstrip Preparation

The filmstrip is the visual component of the audio tape. It is a series of projected still pictures accompanying a tape recording. Although filmstrips may be used without sound, they have not been used in the projects described. With respect to sound filmstrips, controversy is possible as to whether the pictures should illustrate the commentary or whether the words should explain the pictures.

Examples of both these philosophical approaches appear in the media produced, but the procedure described calls for simultaneous planning. Although many illustrations are normally aids, enrichments, supplements or reinforcements of the recorded message, there are frequent examples of the reverse, where a picture, drawing, graph, or projected words present the idea and the commentary may do no more than to direct attention to details or ask questions requiring answers based on the visual presentation.

The preparation of filmstrips requires a production team, the team being composed of the electronic technician, the artist and the photographer, in addition to the teacher-author. Notwithstanding the opportunity for artistry, it is safe to assume that in every school or school system there is sufficient talent to design effective sound filmstrips.

For development of the illustration series, the "story board" method is used, much as is done in the planning of instructional motion pictures. Each frame of the series is numbered and sketched on a simple form which has a picture area outlined in the ratio of 3 to 4, the proportions of the filmstrip image when projected on the screen. Space is provided for notes to guide the artist and photographer. Provision is made for noting the photography record if desired.



7

18. Girl

are satisfying. If you can arrange that the student's efforts usually result in him achieving his goals or making recognized progress toward them, you will be more successful than if he constantly finds no satisfaction and sees no progress. The individual wants (1) evidence of progress and (2) success in satisfying

Filmstrip

Frame 18

Description: Photo-CU

Pleased young woman with good report.

19

20

, CU

ace portrait.

Development of Story Board

Completed Story Board

The story board is the stage at which the visual design determines the effectiveness of the finished medium. When the complete series of sketches is thumbtacked in sequence on a tackboard, it can be quickly read and visualized by all interested parties. Improvements and changes are easily made. This is, in fact, the last chance to make improvements in the illustrations and the script without costly waste of labor and materials. When the story board and the script, with accompanying worksheet, are complete, it is time for review and approvals.

Some key steps in preparing story board sketches are:

1. Review the script looking for the ideas for illustrations noted in the margin. Sketch ideas which, when fully prepared, will assist the student to visualize what you, the teacher, had in mind. Remember that what you had in mind may be clear to you, but your words may bring to your students' mind ideas that are far different from yours. Pictures, diagrams, cartoons, sketches and other illustrative material can be used.

2. Make drawings in detail; or a picture may be described in words, or stick figures may be sketched to give the illustrator an idea as to what is wanted.

3. Design filmstrips to average, if possible, one frame change every 30 seconds. This means that a 30-minute milti-media lesson will have about 60 frames.

4. Repeat in written form on the filmstrip frame, if so desired, questions that were put in the script for the audio tape or on the worksheet; the confirmation of the correct answer also may be given on a filmstrip frame or by audio tape. The confirmation can be given with a new emphasis, or with a statement as to why the other alternative answers on the objective check up questions were wrong.

5. Review script and place a red check mark in the places where the student will be given the sound cue or voice count for the changing of the filmstrip frame.

The draft illustration entered on the story sheet, with added notes, may take a variety of forms. It may be typewriting or hand lettering, to be photographed directly from the story sheet. It may be a simplified line or circle graph in colored pencil, to show the general form to be used for an accompanying set of data. Most often, it will be a simple sketch descriptive of a photograph or an artist's drawing. Tracings and clippings may be used.

Making story boards call for no high degree of artistry, but the better the illustrations, the better the planner's ideas are conveyed to artist and photographer. Stick figures can be substituted for people in action, and plain ovals for heads in medium close up shots. The poorer the sketch, the greater the need to resort to written description. Sketches made in pencil are adequate but, when color is important, the addition of colored ink or colored pencil is the best way to guide the artist.

While the story board can be simple, even crude, the ideas represented require the best available skill of the planner. To conserve time in production, the approved story board sequence can be broken down, with frames requiring printing going to a typist, those requiring hand lettering or mechanical drawing to a draftsman, those needing cartooning, drawing or graphs, to the artist, and those for camera work being given to the photographer. The script can be given simultaneously to the narrator and the sound technician. Worksheets can go to the typist and duplicating department.

It is well to keep a master file of the script, worksheets and story boards to assure that none of the parts get lost and that they all get properly reassembled. This entails only carbon copies of the script and photo copies of the story board sheets.

Worksheet Preparation

The preparation of worksheets that accompany the audio-tape and filmstrip requires the following steps:

Step 1. Write an introduction to the worksheet.

  a. Tell the student the performance goals expected of him.

  b. Tell the student about the cues, either audio or visual, for advancing filmstrip or turning off the equipment. The student becomes active in the learning experience by merely reacting to the cues.

  c. Tell the student how to start using the equipment.

Step 2. Review the script to determine what questions are asked or what evaluation activities are proposed.

Step 3. Write the question or directions for proposed activities and provide space for student-written responses. The worksheet should be designed in relationship to the point at which the student will write his answers, work problems, make sketches, or report on his directed study.

Step 4. Number questions or activities so that they correspond with the filmstrip frame numbering. This is done to synchronize the worksheet activities with the audio tape and filmstrip.

Step 5. Provide space for the student to write in corrected answers after he learns of a mistake through the confirmation statement on the audio tape or filmstrip. The student should be given directions to restudy the information presented on the audiotape and/or filmstrip and to then write the corrected answers in the worksheet.

Step 6. Provide directions as to where the worksheet should be submitted after it has been completed, so that it may be checked.

Step 7. Prepare a post-test for the student to take, covering each of the specific performance goals. Such a post-test should have direction written on it setting forth test conditions, so the student and the instructor can determine with accuracy how well the performance goals have been achieved.

Step 8. Select an approximately average student and ask him to use the multi-media materials in rough form. This can be done from the typed script and from the art work before the filmstrip is made.

Step 9. Observe the student closely to determine where he has difficulty in understanding the instructions, where he has to repeat the material once or more frequently in order to answer the question or perform correctly the evaluation activity. The materials should be revised at such points for greater clarity.

Step 10. Correct script, story board pages and worksheet questions as needed.

Step 11. Duplicate worksheets for student use.

Art Work

The artist, working from story board sketches and referring to the script as necessary to understand fully the context and ideas, prepares each frame on art board about 8 x 10 inches in size. Each frame is numbered on the back to correspond with the story sheet.

Any artist's medium may be used. For outline work, a Leroy lettering pen and India ink are good. Adhesive sheets of transparent, colored plastic speed the work of coloring areas, but small color areas are done with brush and ink or water colors.

Frequent use is made of pasted, ready-made illustrations, alone or in combination with drawing. Copyrights should be observed and permission must be obtained if protected illustrations are used. Much good illustration material is available which is not copyrighted. Some possible sources are national and state government publications, advertising leaflets, brochures of

Preparing Filmstrip Illustrations

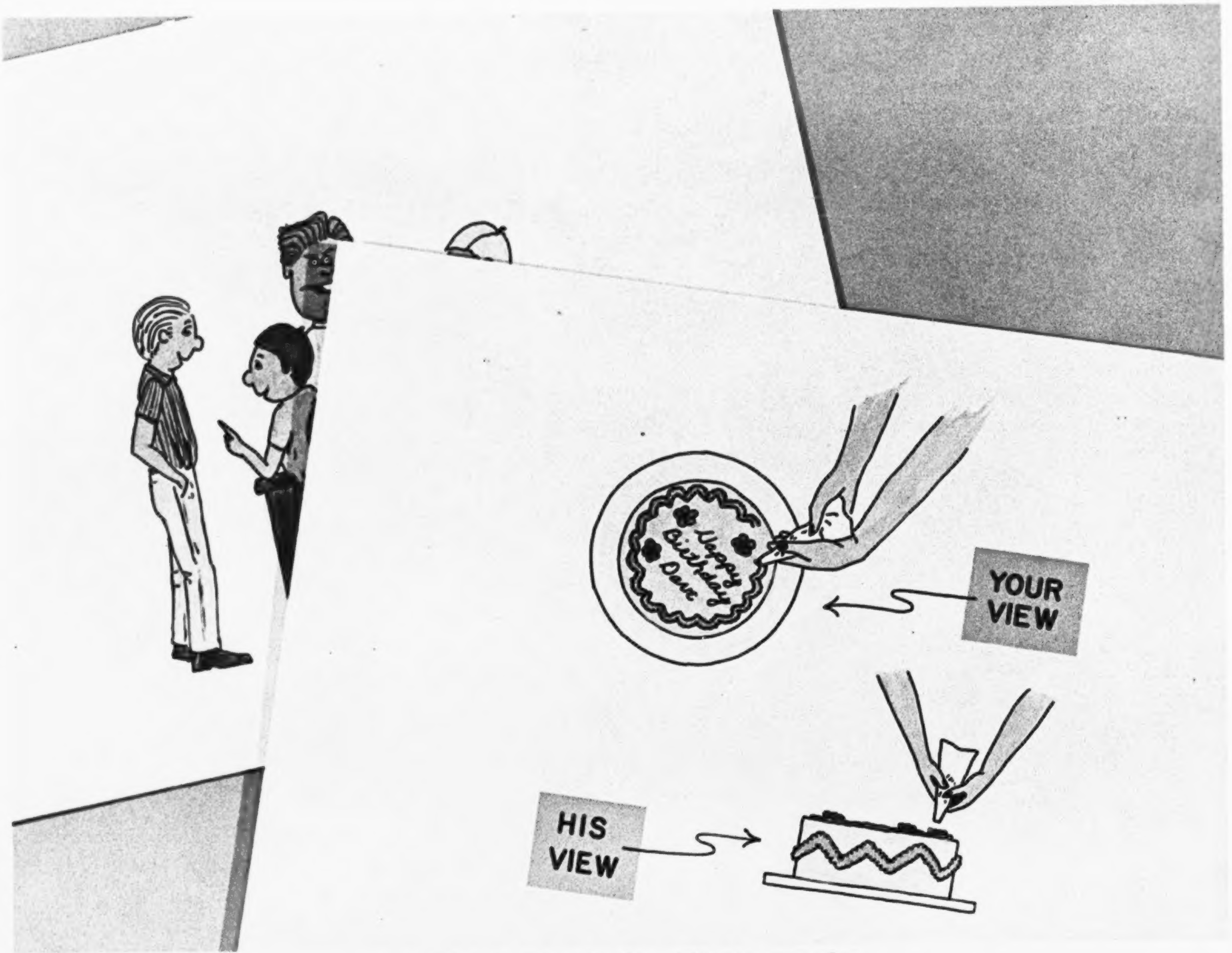
non-profit agencies and institutions, and commercial materials sold for aid in illustrating. A resource file is easily built.

While the 8 x 10 size serves for most work and facilitates filing, photographs may be of any size. Mechanical drawings and graphs or charts are made larger.

Cue numbers are not painted on the art frames. Sets of such numbers may be purchased; these are printed on small paper discs in two sizes, 3/4-inch letters for 8 x 10 copy and 1/4-inch for smaller photographs. These are simply laid on the work when the master print of the filmstrip is being photographed.

Lettering and Printing

Main titles, credit frames, start frames and end frames are lettered on transparent plastic sheets. This permits overlaying subtitles in a set of filmstrips without repeating the main title. Unless a special form of lettering is wanted, the quickest way to do mechanically perfect lettering



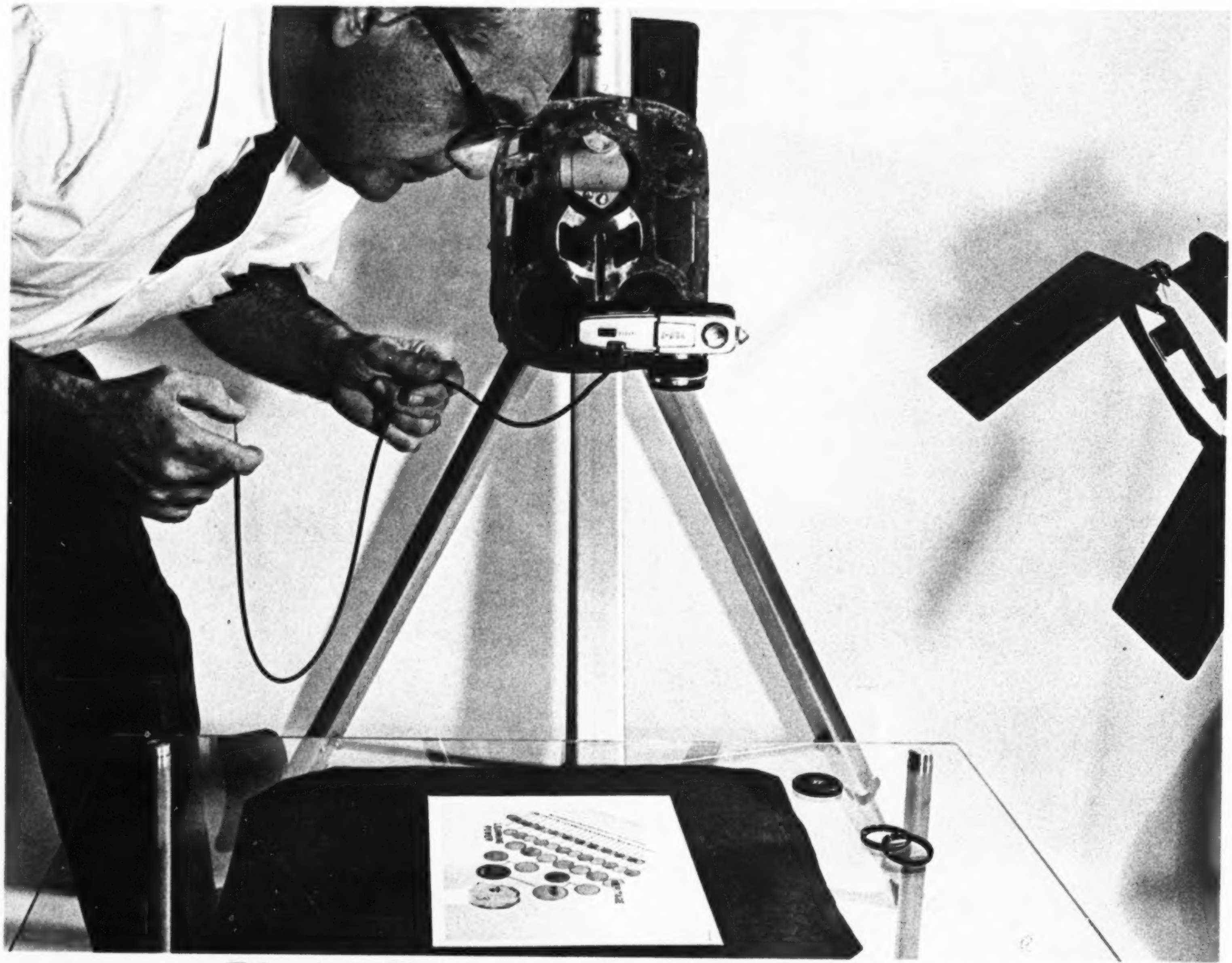
Art Work Ready for Photographer

is to use the transfer lettering sheets now available from suppliers of materials for making overhead transparencies. Each letter is transferred from the purchased sheet to the title sheet by merely positioning the wanted letter and rubbing it with a smooth instrument, such as a fountain pen cap. Smaller lettering on paper is often done with one of the mechanical lettering sets used by draftsmen. This works well for labels or outline charts.

Printing or typing is done with primary electric typewriters with proportionate spacing for uniformity of print or, if printshop equipment is available, with a Varitype machine. The latter makes possible a greater variety of sizes and styles of print, and also can produce justified (even) lines.

Photography

The photography for filmstrips is done by a staff photographer in two stages. When the story board calls for a mixture of persons or objects that cannot easily be arranged in a still life composition, a preliminary print or transparent positive is made. This is a 4 x 5 Polaroid color print or a 2-1/4 x 3-1/4 color transparency.



Filmstrip Photography Using Half-Frame Camera

Polaroid prints have the advantage of immediate processing. If the first attempt is not entirely satisfactory, another can be made. This eliminates possible need to return to or reconstruct a scene. However, some difficulty may be encountered with either exposure or development, which can significantly increase the cost of materials. When the convenience or immediacy of these paper prints is not essential, color transparencies are preferred because they give better color and sharpness when re-photographed in the final stage.

In the final stage, titles, art work and preliminary prints or transparencies are photographed in proper sequence with a 1/2 frame, 35 MM single lens reflex camera, with filmstrip spacing between frames. The camera is used on a copy stand and the copy is illuminated with special Halogen lights to maintain color balance. When color transparencies are re-photographed, they are lighted from the back on a special copying device.

The final photography of the master print is critical. It is done on color negative film. Each exposure must be correctly framed, focused, and exposed. Any variation in exposures will appear in all prints of the film strip. Splicing or other correction of the master copy is difficult, but not impossible. The visual numbers must be placed on every fifth frame.

Inexpensive Photographic Equipment

The necessary control of all photographic factors while shooting the final sequence of art work, color prints and small objects or arrangements requires professional skill, but it can be done with modest equipment. Three cameras are used: a 4 x 5 Speed Graphic with Polaroid back, a 2-1/4 x 3-1/4 press type or double lens reflex, and the 1/2 frame, 35 MM mentioned above. Accessories include lights, copy stand, slide copy device, a set of close-up attachments, and light meter. A collection of color backgrounds of cardboard, paper, and cloth is used, and some plate glass and metal bar hold-downs.

Processing of the color negatives is done at a commercial laboratory. A proof print is returned and, if satisfactory, the required number of filmstrip prints is ordered. They are delivered in one continuous roll and must be cut apart and loaded into cans or special holders if auto-load projectors are used. The cans or holders must be labeled.

The master print is kept on file, permitting additional prints to be ordered at any time. Art work and photographs also are filed for re-use in possible revisions or additions to a filmstrip series.

Associated Media

The experimental work described in this presentation was confined primarily to the use of filmstrips rather than individual slides. There is no reason, however, why such slides could not be used successfully in preparing individual multi-media instructional programs. Film strips have the advantages of minimal storage space requirements, unalterable frame sequence when this is important, and less expensive reproduction costs when additional copies of the strips are needed.

On the other hand, individual slides are easier to edit by removing or replacing individual frames, a very important factor in keeping a series up to date. Projectors for showing individual slides are quite common and reasonable in cost because of the popularity of this medium with the general public. Filmstrip projectors are not as widely used as in the past, and for this reason are a little harder to obtain and service.

Individual slides are very easy for teachers to make, using the popular double-frame 35 MM cameras. If one slide in a sequence is poorly done, it is not a great problem to take another, and both film and processing services are readily obtainable, quick, and relatively inexpensive.

Whether filmstrips or slides are to be selected for development of the individualized multi-media instructional programs is for the school personnel to decide, but it is important that one system be used rather than a combination, to avoid confusion and waste.

While filmstrips and/or slides and tapes are of primary importance in these projects, other forms of media are necessary as well. Accompanying duplicated instruction sheets, worksheets, forms, outlines, and syllabi are a regular part. Ordinarily, the customary stencil duplicating machine or the spirit process is used. These processes are so common that they require no description. Where two-color work or other special requirements justify it, offset printing facilities have been used to reproduce instructional materials.

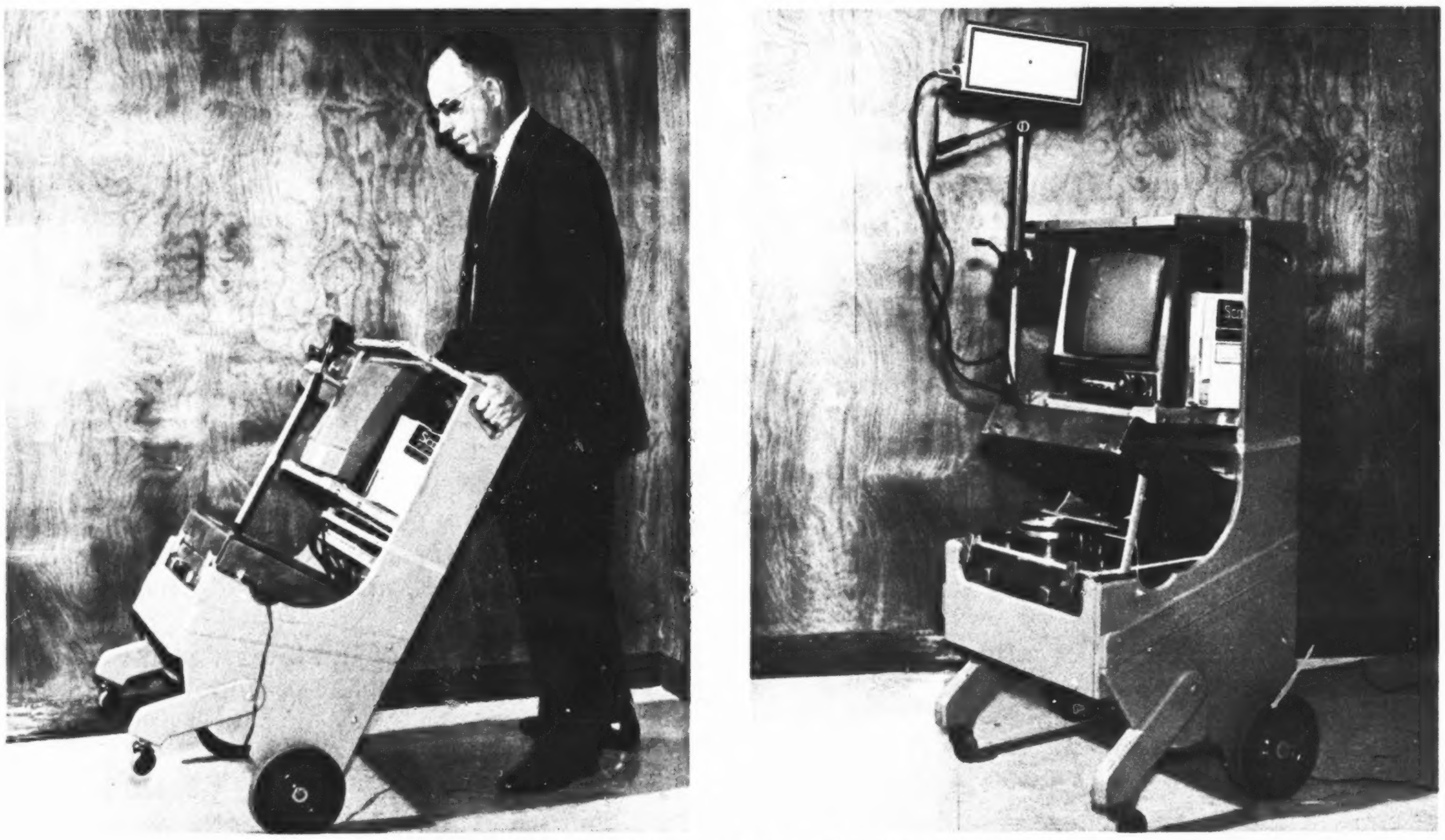
Sets of overhead transparencies occasionally have been prepared for lectures and discussions. These are hand made or prepared for duplication on transparent plastic sheets by thermo-copy duplicators. Materials are available from audio-visual supply houses.

Series of opaque pictures also have been used in group meetings. These may be either stack mounted on cardboard, or pasted in sequence on a long band of paper, folded in accordion fashion for ease of filing.

Flannel boards, charts, sets of flip charts and, of course, the old reliable chalkboard will all continue to serve their purposes in group instruction.

In the teacher training project, video recordings are used to study and improve teaching performance. The early efforts were made with still pictures from the 35 MM camera and tape recordings, made during class sessions. Pictures were taken of the teacher of the class every two or three minutes, while the audio tape recorded continuously. Various locations and combinations of lavalier and stand-supported microphones have been tried. The combination of photographs or slides and audio tape gives the teacher a good record of the verbal component of his work as well as a review of the visual component. These enable him to review and evaluate with a teacher trainer many aspects of his application of teaching principles.

To obtain a better record of teaching performance, a small video recording outfit has been assembled. A cart has been designed and built which enables the outfit to be transported in the



Portable Video Tape Equipment

trunk of an automobile, wheeled into a classroom, and quickly set up. When the desired video recording is completed, the outfit is quickly disconnected and wheeled out of the classroom with a minimum of distraction.

The cart carries the recorder, the monitor, which also is used as the television screen for playback, the camera or scanner, the microphone and a spare reel of tape. All cords are connected. In the classroom, all that is needed is to remove the camera from its compartment, mount it on the tripod head, and plug in the power cord. One person can operate the apparatus. Results of this technique look promising. Teachers like the opportunity to see and hear themselves in action and they have no difficulty in spotting techniques which they can improve.

Further experiments are in progress to (1) compare the cost and effectiveness of the still picture record with the motion recording and (2) improve the technique of using the video equipment both in the classroom and in the follow-up review and conference.

It is anticipated that further use may be made of video recordings to provide demonstrations of model teaching methods in various occupational fields.

CHAPTER V

EVALUATION OF THE INDIVIDUALIZED MULTI-MEDIA INSTRUCTIONAL SYSTEM

Various evaluation methods must be tried at regular intervals in an effort to assess the effectiveness of each element of the individualized multi-media instructional system. Evaluation must be carried on under a variety of actual classroom conditions and with each of the subjects being taught with the instructional system. No comprehensive, reasonably reliable evaluation of the individualized multi-media instructional system is likely to occur during the first year it is in use. This may be true even for four or five years, because there is no known means of making a thoroughly effective instrument for its total evaluation. This is particularly troublesome in evaluating trade-technical education when the number of students involved is small, thus limiting the setting up of experimental and control groups through the research methods available at present. However, in spite of these problems confronting those who try to face up to the important task of evaluation, some attempts have been made, and the results obtained appear to give evidence that the individual multi-media instructional system helps students attain greater depth of learning.

Evaluation of Multi-media Instruction in Colleges

A study by Bruce Monroe of seven colleges scattered across the United States that were using some variation of multi-media instruction for academic subjects found:

> If the material to be taught is programmed so as to get an ideal teacher effectiveness, the results could, in theory at least, make a 40 percent difference in the learning over which the school has some control. In the average class using traditional methods, about 75 percent of the students are achieving 75 percent of the goals.[1]

In his analysis of the courses taught with the individualized multi-media instructional system at Mt. San Jacinto College, Monroe found that 85 percent of the students achieved 80 percent of the goals.

---

[1] Bruce Monroe, "A Report on Multi-Media System." Unpublished report to the faculty of Mt. San Jacinto College, Gilman Hot Springs, California, 1967.

Among his other findings concerning the multi-media classes at Mt. San Jacinto College was that students perceive their efforts as being more necessary and important when studying with multi-media instructional materials. A number of randomly selected students reported in structured interviews that the multi-media courses were of more importance and of higher priority to them when they engaged in individual study in the study booths, in comparison with the study they did elsewhere. The students perceived that they studied more diligently in the multi-media courses than they did for the rest of their programs and, with few exceptions, said that they studied longer and more conscientiously and were more successful in the multi-media classes than they were in their other scheduled classes.

Monroe found that if students were deprived of practice with the multi-media materials, their achievement dropped about 11 percent. He did not find why this happened; however, he suggested the following possibilities:

> It may be simply a lack of direction; it may be that they need the practice. It may be that they need the emotional support. We know if you subtract something within the media program you minimize the student's achievement for the period of time. It's particularly noticeable in a poor student. Media courses appear to be more necessary and essential for the less independent student.[2]

Additionally, Monroe found that when behavioral objectives are described in terms of what the student will be doing, along with the multi-media instruction, the two interact positively. A lack of objectives plus a lack of multi-media instruction was found to be doubly disadvantageous for students, when compared with those students having a knowledge of the behavioral objectives and a chance for programmed practice with multi-media materials, which provide continual information as to learning progress.

It was found that knowledge of behavioral objectives was of greatest assistance to the more dependent students. Many students in college need to be told in a very direct fashion what is expected of them, by what date, and at what level of competency.

One of the major findings of Monroe's study was that there is a process of continual revision of multi-media courses. He found that the objectives get revised, the instructional strategy changes, the methods of program practice vary, and the multi-media instructional materials are evaluated and revised more often than occurs in traditional course instruction. In short, putting a course on a multi-media basis guarantees that it is going to be revised more frequently than a traditional course.

Evaluation of Trade-Technical Teacher Education, Spring 1967

The experimental trade-technical teacher education class conducted at Mt. San Jacinto College during the Spring of 1967 was evaluated in the terms of student performance goals. The stated student performance goals were written for each unit of the course and presented in the course syllabus. Qualitative and quantitative judgments were based on seven techniques listed below:

1. Tests: A pre-test covering selected units and topics to be taught, a midterm, a special test on Unit IV, and a final examination. Selected questions were repeated in this series of tests to give statistical indication of growth in knowledge of course content, particularly through the first half.

---

[2] Ibid.

2. Worksheets for each filmstrip, requiring responses which show understanding and, wherever practical, application of principles and techniques to the organization or practice of the teaching work of the student.

3. Assignments, written or drawn, based on ideas presented by the media.

4. Discussion of applications and problems in small group sessions of 9 to 12, in which students were expected to demonstrate their grasp of ideas presented.

5. Observation of classroom practices of the student. Some students had their lessons video taped and their teaching practices analyzed by the instructor and the student (this activity was limited by circumstances).

6. Evaluation of student achievement by the use of 57 items recorded on a progress chart.

In addition to satisfactorily completing all the assignments, some significant results follow. In the unit on student performance goals,

1. There was an overall 49 percent gain over the pre-test in recognition of the three essential elements of student performance goals.

2. The class scored 76 percent of 720 possible points on the identification of essential elements, which, broken down, showed:

   a. 93 percent recognition of observable behavior.

   b. 78 percent recognition of conditions of performance.

   c. 74 percent recognition of standards of performance.

   d. 69 percent recognition of the simultaneous presence or absence of all three essentials.

3. In Unit IV, which was concerned with learning, the unit was taught by lecture from script. A test revealed unsatisfactory ability to recognize applications of three "laws of learning." The same content was presented by multi-media, and a re-test showed approximately 90 percent mastery overall. The worksheets showed a universal understanding of a basic procedure for using multi-media in general. No attempt was made, however, to teach equipment operation.

Evidence in worksheets and assignments showed that everyone learned to use the most comprehensive indexes and catalogues to locate and select media of several kinds. Descriptions, sketches and designs submitted for chalkboard, chart, and display materials were rated either satisfactory or, in many cases, superior. All either described a system of filing and storage or designed one for the future, including free and inexpensive materials. All submitted samples of instruction sheets, most of which were exact and satisfactory in form and content.

Some of the above evaluative comment applies to the teaching of the experimental course rather than to the effectiveness of the multi-media materials, since one-third of the filmstrips and tapes were not ready for use when needed. However, the resulting substitution of lecture for individual study media provided some opportunity for comparison of method. Certainly the individual study media resulted in better application and feedback than when group lecture was used. The course evaluation reports made by the students, as well as class discussion, showed that students liked the multi-media presentation, particularly after they became accustomed to it. Students consider beneficial the opportunity to make immediate application of their learning to their work.

Evaluation of Trade-Technical Teacher Education, Summer, 1967

An effort to test the effectiveness of individualized multi-media instruction for trade-technical teacher education was conducted in connection with the University of California Core Program held during the summer of 1967. Eleven matching pairs of students were selected, divided into experimental and control groups of 11 each. All attended the first half of the Core I program at the University of California and completed the mid-term examination. The control group continued in the same classes, but the experimental group completed the second half of the Core I class in an individualized multi-media program at Mesa College, San Diego.

The 11 pairs of students included in the experiment were matched by sex, age, and occupation at which they had worked prior to entering teaching, their years of work experience, educational attainment, and scores on a SCAT test. One pair of students was in automotive mechanics, one in aviation mechanics, one in dental assisting, six in nursing, one in police science, and one in welding.

The matching was made possible by the large number enrolled in the Core 1 program (over 225). While matching was not perfect, differences were of minor scope: a maximum of three years difference in the ages of the paired students, five years difference in work experience, and one C score on the SCAT test. Matching by occupation, educational attainment and sex was exact.

Although both experimental and control group received the same type of instruction while attending the first part of the Core 1 classes, the experimental group, attending smaller classes in San Diego for the second half, used a variety of multi-media materials. (These materials, incidentally, also were experimental in nature in that they were being developed for use in trade-technical teacher education.) In addition, the San Diego class was small enough to provide opportunities for the small-group sessions that are a feature of multi-media instruction as presented here.

Table 1 displays the comparison between the experimental and control groups, for results of the mid-term and final examinations. There was high correlation in results for all students at both mid-term and final examinations. The experimental group as a whole, however, appeared to have a slightly higher overall level of achievement. On a Fisher "t" test, there was no significant difference between the two groups.

Table 1.
Comparison between Experimental and Control Groups,
Core 1 Program, Summer Session, 1967

	Mid-Term		Final Examination	
	Experimental	Control	Experimental	Control
	(N=11)	(N=11)	(N=11)	(N=11)
Mean	50.09	49.00	171.90	167.09
Standard Deviation	5.50	5.15	27.13	30.91
Correlation	< .81467 >		.66950	

Although the sample is small and considerably more evaluation will have to be done before possible trends can be identified, these beginning results are encouraging.

Evaluation of Automotive Mechanics Course

The only evaluative measurement in the Automotive Mechanics course at Mt. San Jacinto College, at this writing, shows a gain from using filmstrips and tapes in addition to group instruction. This finding is based on comparison of results when one class was divided into approximate pairs on the basis of the School and College Aptitude Test (SCAT). On the basis of this pairing, the students have been divided into two groups, of which one used the multi-media materials in addition to the group instruction.

Students are tested with short-answer objective tests which have been written to determine whether they are able to meet the achievement goals. Whenever possible, the multi-media learning, combined with a shop job, is tested by use of a performance test.

A test on an instructional unit on clutches showed improved scores for every student in the group assigned to use the additional media. The mean gain by individuals was 11.4 percent of the possible test score. The gain for the entire group using the multi-media materials over those who did not was 11.5 percent of the possible score. These results are preliminary; they are being followed up by a more extensive evaluative procedure.

The approved evaluation procedure includes provision for obtaining adequate data of several kinds. The variables to be considered in the automotive studies will include manipulative skills.

Evaluation of Auto Body and Fender Repair Course

The Auto Body and Fender multi-media program at Mt. San Jacinto College is in the initial stages of evaluation. Students will be randomly assigned to experimental and control treatments for selected units. Contextual variables will be held constant. The criterion variables for this study will be effects on retention, articulation, transfer, and performance; and specifically, scores on unit and final examinations, and instructor's rating of work. Gain scores between pretests, and unit achievement tests, will be used to compare treatments. An analysis of variance between group means will be the principal statistical measure.

Evaluation of Future Progress

There is an increasing need for more sophisticated and accurate evaluative instruments. It is essential, for example, to devise a means of continually measuring the total growth of student ability and understanding, rather than merely finding out what facts they possess. Changes in the student's development must be closely observed and the instructional program should be so correlated with student development that instructional emphasis can be given to each student's needs.

There is danger that inadequate evaluation may serve to perpetuate the status quo in education. For this reason, evaluation must become broader and deeper, involving more persons and things, and utilizing the resources of a growing list of disciplines.

Essential elements from research in many fields will help to provide a system for continuous evaluation. Individualized multi-media instruction, as all other instruction, also must be continually evaluated and refined, so that it becomes a dynamic adjunct to the entire instructional process. Evaluation results should provide both verbal and statistical information that evoke confidence in the findings.

In trade-technical education, evaluation is at the threshold of new developments in effective instruments and techniques. The imagination and resourcefulness displayed in the many innovative programs in trade-technical education will inevitably be reflected in the development of the necessary instruments for continual instructional evaluation. This, in turn, will lead to instructional improvement and the assurance of highest possible standards of instructional quality in trade-technical education.

CHAPTER VI

FUTURE IMPROVEMENT AND EXPANSION OF THE INDIVIDUALIZED MULTI-MEDIA INSTRUCTIONAL SYSTEM

Basic Concepts

Providing individual instruction for each student has been an aspiration of educators for many years. Technological developments coupled with research are contributing techniques, methods, and instructional equipment that permit the achievement of individualized instruction. Individualized multi-media instruction is not a universal formula for teaching the many learnings required by a student. As in the case of all other teaching devices, it has its advantages and its limitations; thus, it must be utilized properly and in the areas of learning experiences in which it can contribute most effectively. Having the hardware in a school without applying the principles of curriculum development and instructional utilization may prove disastrous to the educational venture. The proper creation and use of student performance goals, planned feedback activities for varying sizes of student grouping, and effective techniques for evaluating the instructional system in achieving prescribed goals, are some of the major elements needed to make the individualized multi-media instructional system effectual.

The individualized multi-media instructional system now being applied in trade-technical education is in the early experimental stages. Improvements and expansion of this instructional system are being made through trial and evaluation. In trade-technical education, this system strongly supports cognitive and planned concomitant learnings. Motor skill development utilizes other instructional systems and experiences. There are, in addition, many cognitive and concomitant experiences that need to be gained through group interaction. The nature of personal interrelationships, in the world of work as well as in personal activities, requires skills developed through human interaction. The individualized multi-media instructional system, when used properly, provides not only for individualized instruction but for group interaction as well.

When an instructor is freed from his routine lecturing through the use of the individualized multi-media instructional system, he can spend more time with individual students and better utilize his tutorial time. He has a better opportunity to increase the student's motivation to learn and both to attain short term goals and to achieve long range occupational skills and knowledge. On a one-to-one basis, the instructor sparks the student's interest in individual investigative activity and independent study that go beyond precisely prescribed assignments. Through instructor-to-student discussion, the instructor has greater opportunity to help the student think objectively, and in many cases creatively, about what may appear to be routine tasks.

Many instructors, when first beginning to use the individualized multi-media instructional system, tend to use small group sessions for lecture or review, rather than for developing carefully planned discussions. The difficult technique of leading a carefully planned discussion, so that students are required to verbalize their understanding of the instructional information they learned through the multi-media instructional system, must be developed by instructors who use this particular instructional system. The instructor must devise discussion activities and create methods of questioning so that the instructor can ascertain how well each student has learned. The instructor must develop teaching skills that keep the small group sessions focused on the discussion topic without the instructor's dominating the discussion. He must also assist each student to learn from his fellows the learnings each has gained through independent study.

Through the trade-technical teacher education program that incorporates individualized multi-media instruction, the instructors will have experiences and develop skills that will permit them to utilize most effectively all facets of the multi-media instructional system. These skills are achieved in teacher education through practice in the concept of "trendication analysis," the system of interpreting student feedback responses in relation to student performance goals to detect how well each student has learned, and prescribing activities that will assist each student achieve to an ever greater degree.

Associated Techniques

Large group instruction can be improved in many ways. One way which is being tried at Mt. San Jacinto College is through the student response system. This particular system was developed at Mt. San Jacinto. Each tablet arm chair in the classroom is wired with four toggle switches under the desk arm. Wires from these switches go to a teacher's console and light up four lights of different colors. When the instructor is presenting a lesson which has not yet been placed on multi-media, he makes a brief explanation and then asks a question which must be answered by all the students by throwing one of four switches. The instructor can scan the console to check how many students failed to answer correctly, and he then can give confirmation of the correct answer and, if necessary, re-teach.

The trade-technical teacher education staff, California State Department of Education, Bureau of Industrial Education, located in the Division of Vocational Education, University of California, has developed a portable battery operated student response box. Each student has his own response box at his desk. The response box has four lights, four push button switches, and a reset button. The lights and push buttons are so arranged that other students cannot readily see either the lights or the switch that were activated by an individual student. The reset button is deliberately located in front of the box so that the instructor can see if a student changes his mind in order to turn on a different light. All lights remain lit until the student resets the lights to "turn off." The utilization of this device in teaching is similar to the system used at Mt. San Jacinto College.

Where motion is an indispensable part of the teaching process for demonstrations and for developing new concepts, an 8 MM sound motion picture can be used. The film is viewed by the student in an individual study booth, using one of the new cartridge-type sound motion picture projectors designed for this purpose. When the 8 MM color, sound motion picture is available as a medium for individualized instruction, it should be selected and utilized when its use is most advantageous for the learner.

The filmstrips, audio tapes, and programmed worksheets described earlier have so far been designed to follow a modified linear programmed format. All students go through all steps of the instruction. "Branching" programmed materials hold much greater promise for the multi-media system because they enable students who select a wrong answer from a multiple-choice list to be given an explanation as to why their choice was wrong. Branching can be used to assist a good student to complete the program much faster than the average or slow-to-learn student. A branching program can be used to give the student a choice in regard to the depth that he wishes to go in a given subject. These added features of branching programs are provided through audio and/or visual instructions to the student as he progresses through a multi-media instructional unit. With availability of extra time and money, and greater sophistication on the part of instructor-authors, it is feasible to develop branching programs.

Video Tape

The use of video tape as a technique for assisting with large group instruction or for making a record of small group activities is being incorporated with the individualized multi-media instructional system. Video taping is used with individual students to let them see how they operate a complex machine, or to let them see and hear how they sound when they are making a customer contact or being interviewed for a job through role playing.

Video taping is also used in trade-technical teacher education to help teachers improve their teaching. The technique used with teachers is to film them in their regular classrooms over a short period. This method places the instructor in his normal instructional environment and avoids the atmosphere of artificiality that results when classroom conditions are simulated with non-authentic students and, in many cases, improvised equipment.

After the filming, each teacher and the teacher-educator view and discuss the video tape in a brief private meeting, after which the teacher is filmed again, and there is a second evaluation and discussion of his presentation. The experience of discovering how one looks and sounds when presenting instruction leads to self-evaluation and efforts to correct weaknesses in presentation. Both the filmings and the private discussions are done during the same instructional period. Greater utilization of video tape in the learning process will undoubtedly prove beneficial for all.

Computer-assisted individualized instruction, including audio, visual and written material programmed with many branches to meet widely divergent student abilities, interests and needs may, in the future, make possible the effective teaching of many basic skills and most fundamental knowledge. These computer programs generally provide neither for planned and coordinated student-instructor activities nor for small group discussion. At the present time, the combination of the basic computer and the student stations is too costly for most schools to consider. When the time comes when the three-medium combination (audio, pictorial and typed out material) becomes available at a reasonable cost, instructors and specialists who have developed skills in formulating performance goals and in organizing lessons that utilize filmstrips and coordinated audio tapes will be able to adapt these skills to the new computer-assisted instruction.

Simulation

At least one instructional simulation program, referred to as an instructional "game," has been developed for trade-technical teacher education.[1] This simulation system uses a set of basic data and establishes the criteria for choices which must be made. It is so designed that a computer interprets and evaluates the answers. Educational simulations are being used more and more in other areas of instruction and large group sessions in some occupational fields could make use of this interesting teaching technique. The coupling of multi-media instructional techniques — video tape and other devices that involve as many of the learner's senses as possible — with the simulation technique is another approach for providing both individualized and group instruction that may assist each student achieve his potential.

---

[1] David Allen Simulation and Program Development Strategies. Book 1, Plan of Action; Book 2, Program Development; Book 3, Evaluation and Redirection; Book 4, Long Range Planning. Los Angeles: Division of Vocational Education, University of California, 1967.

Use of Multi-Media Instructional Packages in Continuing Education

Since it is clear that multi-media instructional programs are effective in pre-employment trade-technical classes, there is reason to believe that they offer great possibilities in the field of continuing or trade-education extension. That this can be done is illustrated by the success of the slide and script program started by the American Academy of Orthopedic Surgeons several years ago. The purpose of the program is to keep the surgeons abreast with new research developments in their field. Individual members contract to prepare sets of slides that illustrate such developments, write scripts to accompany them, and make them available to other members through a central booking agency in Chicago.

Announcements of programs available are sent to members, who can order those they want, view the slides and read the accompanying script as they do so, then return the program when they have completed it. Several hundred programs have been prepared, and most of them are in almost constant use.

A very worthwhile service of this kind could be made available for both teachers and practitioners in the various trade and technical occupations. Multi-media packages could be prepared and made available on loan from a central agency so that the latest technical information in every field could be disseminated through the quickest and most efficient means, and at a minimum cost.

A service of this kind could be made almost self-supporting through the collection of modest fees for the use of the multi-media instructional packages. The problem of providing projectors could be solved through the use of inexpensive hand-held viewers.

Such a service might be helpful in solving the problem of the isolated apprentice, and would certainly offer advantages in teaching regular apprentice classes, where individual instruction should be the rule rather than the exception. The potential of the multi-media approach to individualized instruction in extension or continuing trade-technical education is very great, and early efforts to exploit these potentials are certainly warranted.

Converging Activities

A number of activities can assist both the school and the student. These activities relate primarily to the establishment of models for curriculum development, evaluation techniques, and improved instructor skills.

It would be helpful if a state, county, or large city educational agency were to utilize instructors and supervisors to develop a model set of student performance goals for each of the many different occupations for which training is given in the school. Such statements could then be made available for curriculum development and revision to individual faculty members, who then could make necessary modifications in their own curriculums in order to establish appropriate student performance goals for their own students. These student performance goals could be developed in many occupational instruction areas through the use of statewide advisory committees.

There also is need for establishing a model for instructional evaluation. The model should provide for item analysis of the many activities comprising the individualized multi-media instructional system. Results of the evaluation should assist instructors in determining whether their students were meeting the expected student performance goals. This model should make it possible for the instructor to evaluate the total multi-media instructional system, including tutorial sessions, small group instruction, large group sessions, and the utilization of the multi-media instructional materials. The instructor must be provided with evaluative information that helps him to determine what elements of instruction need improvement and what elements are successful, so that he can continually revise and improve his instructional endeavor.

The model for instructor use should assist the instructor in teaching each student more effectively and efficiently. When the instructor is freed from routine and repetitious instruction and he can spend more time assisting students with their individual learning problems as well as working in planned group discussions, it then becomes imperative that the instructor be taught the skills necessary to make his contributions a planned and integral part of the learning process.

The use of machines in the instructional system, however, should not permit the instructor to dehumanize the instructional process, but rather should provide time and establish motives for making the student-instructor relationship more significant and helpful. The model must provide for many methods of involving all of the students, even in large classes. Activities now developing in trade-technical teacher education are oriented to the creation of a model encompassing the concepts presented in this publication. Every effort is being made to assist trade-technical teachers in both the skills necessary for polysensory instruction and in the creativity and boldness that will make their instruction vital and meaningful to each of their students.

APPENDIX A

COORDINATED FILMSTRIPS, AUDIO TAPES AND WORKSHEETS FOR TRADE-TECHNICAL TEACHER EDUCATION

Student As An Individual

Cumulative Records

Principles of Teaching

Methods of Instruction

Motor Skills

Intelligence

Instructional Planning

Instructional Objectives

Levels of Instruction

Introduction to Testing

Test Construction

Economics For Trade and Technical Teachers

Labor Management Development

Student Selection, Placement, Follow-up

Advisory Committees

Substantive Areas

Anthropology of Vocational Education

Textbook Appraisal and Selection

Standardized Tests

Item Analysis

Elementary Statistics

Instructional Aids

Instruction Flow and Environmental Planning

Safety

Grading

Record Systems

Communicating with Potential Students

Job Application Psychology

Instructor As An Individual

Public Relations

Community Survey Information

Performance Goals and Levels Review

Program Evaluation

Specification Writing

Budgeting

APPENDIX B

COORDINATED FILMSTRIPS, AUDIO TAPES AND WORKSHEETS FOR AUTOMOTIVE MECHANICS

Work Orders

Selecting and Using Arc Welding Equipment *

Practicing Arc Welding *

Gas Welding Safety and Equipment

Gas Welding

Conventional Steering and Front Suspension — Principles of Operation *

Wheel Alignment

The Why and How of Wheel Balancing

Ford Integral Power Steering *

Basic Automotive Brakes *

A Brake Job

Clutch and Fluid Drive Systems

Principles of Gears and Standard Transmissions

Overdrive Units

Rear Axle and Drive-Line — Principles of Operation *

Bronco 4-Wheel Drive *

***Commercially produced, in some part.**

Appendix B

Gasoline Engines — Principles of Operation *
Engine Power and How It's Rated
How The Internal Combustion Engine Operates
Diagnosing Excessive Oil Consumption *
Diagnose It First *
Engine Disassemble
Installing Piston Rings In Farm Tractors *
High Power Top Inch *
Measuring and Inspecting Engine Parts
Prescription For Longer Valve Life *
Lubrication of The Internal Combustion Engine
Cooling System — Maintenance and Diagnosis *
How To Assemble Your Engine
How Ford Diesel Engines Develop Power *
Fuel System — Principles of Operation *
Autolite Model 4300 Carburetor *
Fundamentals of Electricity *
Electric Current Principles *
Electric Current Measurements *
Principles of Electro-Magnets *
Application of Electro-Magnets *
An Introduction To The Automotive Electrical System *
Storage Battery Principles *
Storage Battery Operation *
It's Easy To Be An Expert *

---

*Commercially produced, in some part.

Switches, Relays and Lights	*
Gauges and Wiring	*
The Cranking Circuit and How It Works	*
Starting System Principles	*
Starting System Controls	*
Starting System Drives	*
Regulation and The Charging Circuit	*
Generators	*
Generator Output and Regulators	*
Delcotron Generator and A New Charging Circuit	*
Ignition Systems — Principles of Operation	*
Ignition System	*
Ignition Distributor	*
20,000 Volts Under The Hood	*
Rotunda RE 881 Analyzer	*
Transistorized Ignition	
Noise, Vibration and Harshness	*
Diagnosing and Adjusting the C6 Transmission	*
How The C6 Transmission Works	*
1964 Cruise-O-Matic Diagram, Adjustments and Light Repair	*
Hydra-Matic — Principles of Operation	
Hydra-Matic Disassembly, Inspection and Assembly	
How Air Conditioning Works	*

---

*Commercially produced, in some part.

APPENDIX C

COORDINATED FILMSTRIPS, AUDIO TAPES AND WORKSHEETS FOR AUTO BODY AND FENDER REPAIR

- Work Orders
- Selecting and Using Arc Welding Equipment
- Practicing Arc Welding
- Gas Welding Safety and Equipment
- Gas Welding
- Spot Welding
- Switches, Relays and Lights
- Body and Frame Construction
- Quality Body Work
- Water and Dust Leaks
- Windshield and Back Glass
- Door and Quarter Glass
- Roughing Out
- Shrinking
- Filling
- Panel Straightening and Body Alignment
- Panel Replacement
- Frame Alignment #1
- Frame Alignment #2
- Spot Painting
- Paints and Painting
- Painting Equipment
- Acrylic Finisher
- Complete Paint Job
- Estimate Writing